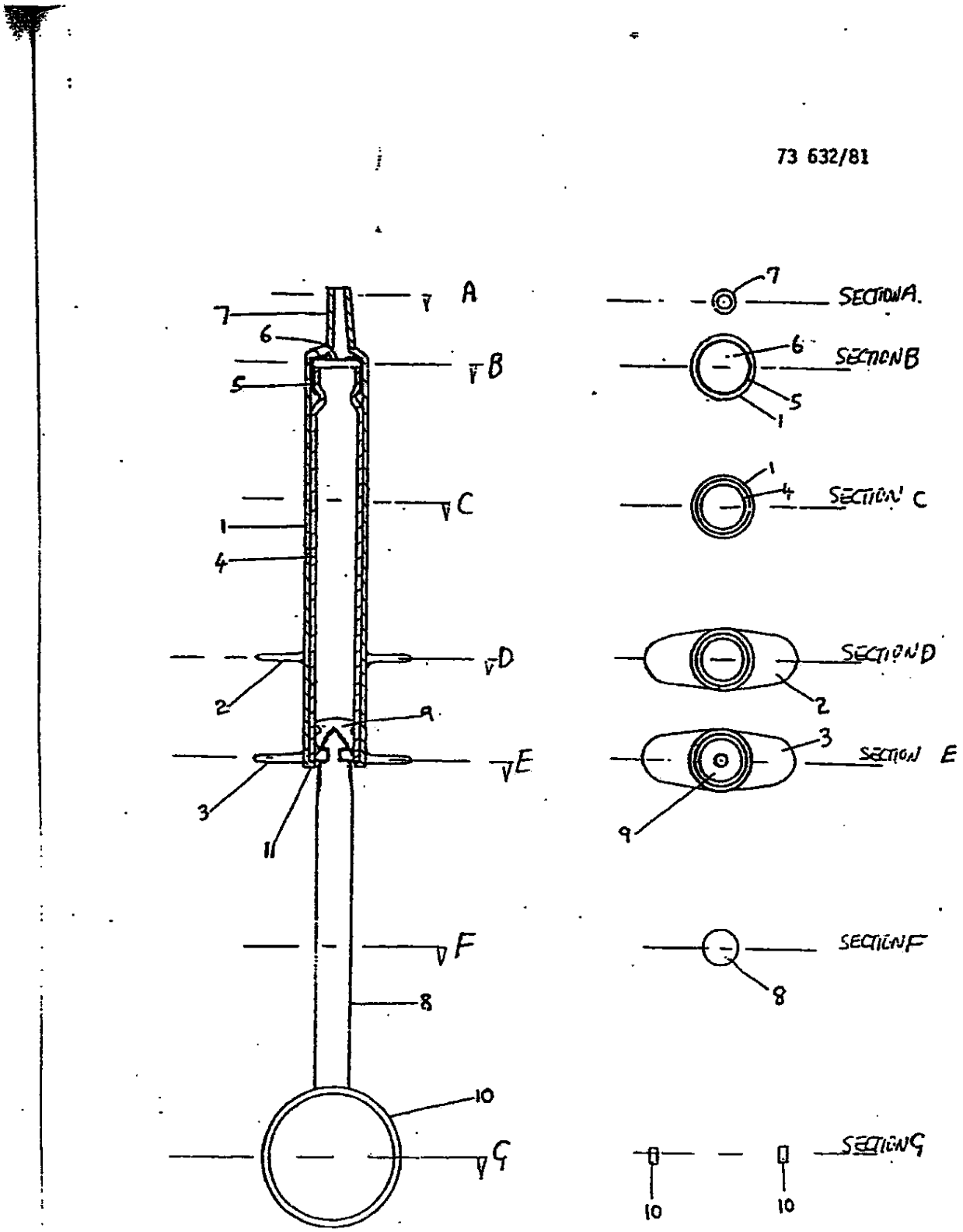
The claims defining the invention are as follows:

Dated this 30th day of July 1981 GEORGE DASKAL

NAME OF APPLICANT
(BLOCK LETTERS)


A
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SECTION A.
SECTION B
SECTION C
SECTION D
SECTION E
SECTION F
SECTION G

Gp 3734

Attorney Docket No.: 5533.200-US

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Buch-Rasmussen et al.

Serial No.: 09/349,748

Group Art Unit: 3734

Filed: July 8, 1999

Examiner: To Be Assigned

For: Medical Device

CERTIFICATE OF MAILING UNDER 37 CFR 1.8(a)

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

I hereby certify that the attached correspondence comprising:

1. Transmittal of Supplemental Information Disclosure Statement
2. Supplemental Information Disclosure Statement
3. PTO-1449 Form
4. Copy of Reference

is being deposited with the United States Postal Service as first class mail in an envelope addressed to:

Commissioner of Patents and Trademarks
Washington, DC 20231

on February 2, 2000.

Carol McFarlane
(name of person mailing paper)

Carol McFarlane
(signature of person mailing paper)

Attorney Docket No.:5533.200-US PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Buch-Rasmussen et al.

Application No.: 09/349,748

Filed: July 8, 1999

For: Medical Device

Group Art Unit: 3734

Examiner: To Be Assigned

TRANSMITTAL OF SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BEFORE MAILING OF FIRST OFFICE ACTION (37 C.F.R. 1.97(b))

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

The supplemental information disclosure statement submitted herewith is being filed before the mailing date of a first Office action on the merits. Therefore, no fee is due.

Respectfully submitted,

Date: February 2, 2000

Elias J. Lambiris, Reg. No. 33,728
Novo Nordisk of North America, Inc.
405 Lexington Avenue, Suite 6400
New York, NY 10174-6401
(212) 867-0123

Attorney Docket No.: 5533.200-US

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Buch-Rasmussen et al.

Serial No.: 09/349,748 Group Art Unit: 3734

Filed: July 8, 1999 Examiner: To Be Assigned

For: Medical Device

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

In accordance with 37 C.F.R. 1.56, 1.97 and 1.98, Applicants submit herewith a reference which they believe may be material to the patentability of this application and with respect to which there may be a duty to disclose in accordance with 37 C.F.R. 1.56.

While this reference may be "material" under 37 C.F.R. 1.56, it is not intended to constitute an admission that said reference is "prior art" unless specifically designated as such.

The filing of this Supplemental Information Disclosure Statement shall not be construed as a representation that no other material references than this listed exists, or that a search has been conducted.

The reference is listed in PTO form 1449 which is in accordance with the requirements of M.P.E.P. 609. A copy of the reference is also enclosed.

The reference is as follows:

1. U.S. Patent 5,688,251.

It is respectfully requested that this reference be considered by the Patent and Trademark Office in its examination of the above-identified application and be made of

record therein. The Examiner is also invited to contact the Undersigned if there are any questions concerning this paper or the attached reference.

Respectfully submitted,

Date: February 2, 2000

Elias J. Lambiris, Reg. No. 33,728
Novo Nordisk of North America, Inc.
405 Lexington Avenue, Suite 6400
New York, NY 10174-6401
(212) 867-0123

Sheet 1 of 1

FORM PTO-1449 (Rev. 2-32) — U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

Atty. Docket No. 5533.288-US | Serial No. 09/349,748

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

Applicant Buch-Rasmussen et al.

Filing Date July 8, 1999 | Group 3734

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
KG		5,688,251	11/18/97	Lawrence H. Chanoch	604	208	09/19/95

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER: Simmons | DATE CONSIDERED: 11/16/00

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

US005688251A

United States Patent [19]

Chanoch

[11] Patent Number: 5,688,251

[45] Date of Patent: Nov. 18, 1997

[54] **CARTRIDGE LOADING AND PRIMING MECHANISM FOR A PEN INJECTOR**

[75] Inventor: Lawrence H. Chanoch, Mahwah, N.J.

[73] Assignee: Becton Dickinson and Company, Franklin Lakes, N.J.

[21] Appl. No.: 530,527

[22] Filed: Sep. 19, 1995

[51] Int. Cl.[6] A61M 5/00

[52] U.S. Cl. 604/208; 604/186; 604/187; 604/232; 222/46; 222/309

[58] Field of Search 604/110, 186, 604/187, 188, 192, 195, 196, 221, 207–211, 232, 71, 72, 218, 224, 234; 222/46, 48, 309

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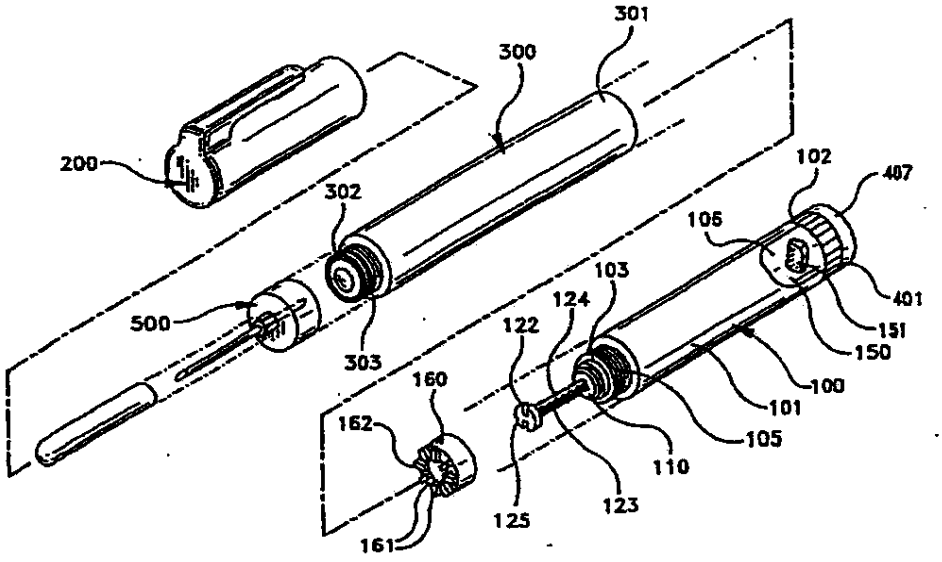
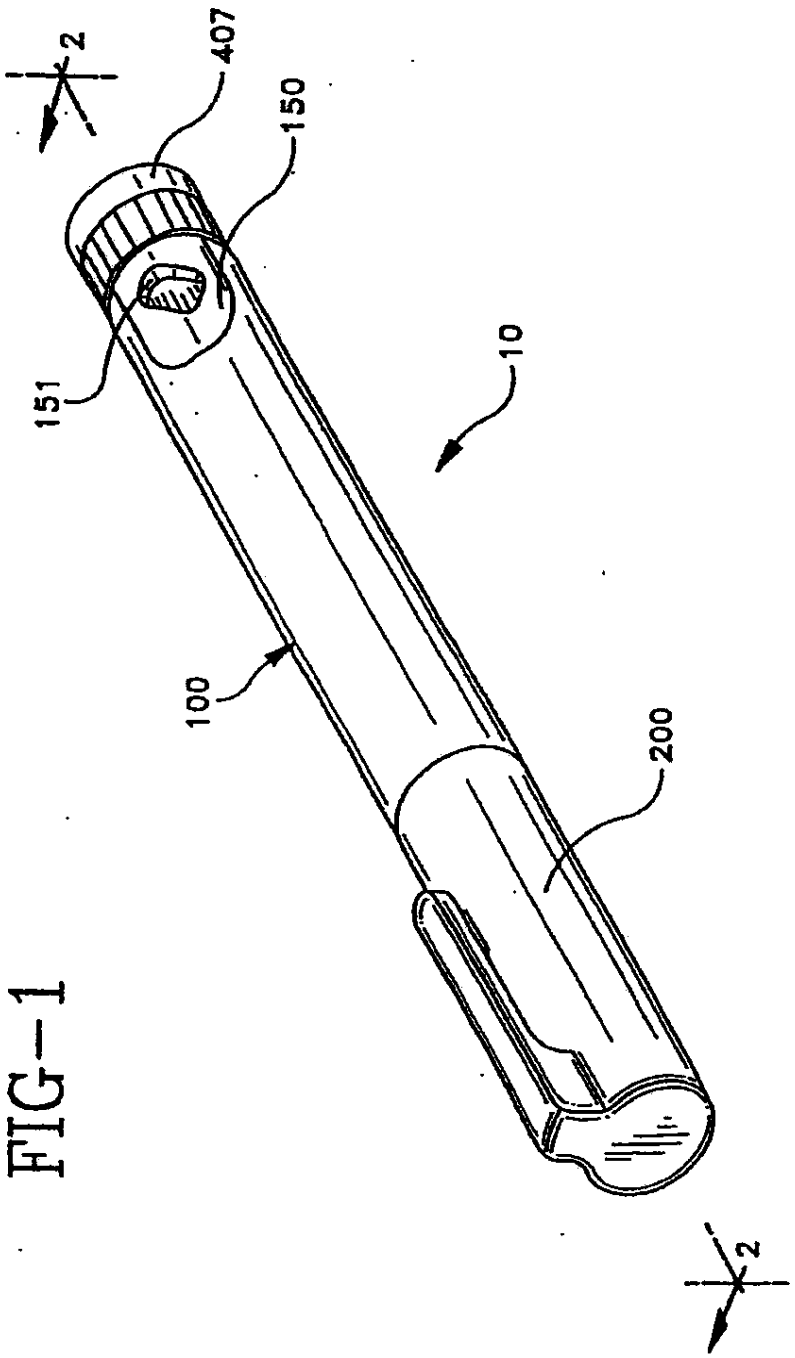
Primary Examiner—Corrine M. McDermott
Assistant Examiner—Cris L. Rodriguez
Attorney, Agent, or Firm—Alan W. Fiedler

[57] **ABSTRACT**

A medication delivery pen is provided having a medication cartridge holder assembly, a pen body assembly and a cap. The reusable pen body assembly includes an improved loading and priming mechanism that allows the user to easily load a new cartridge and prime the pen without having to manually manipulate the pen's lead screw and related driving components.

9 Claims, 5 Drawing Sheets





FIG—1

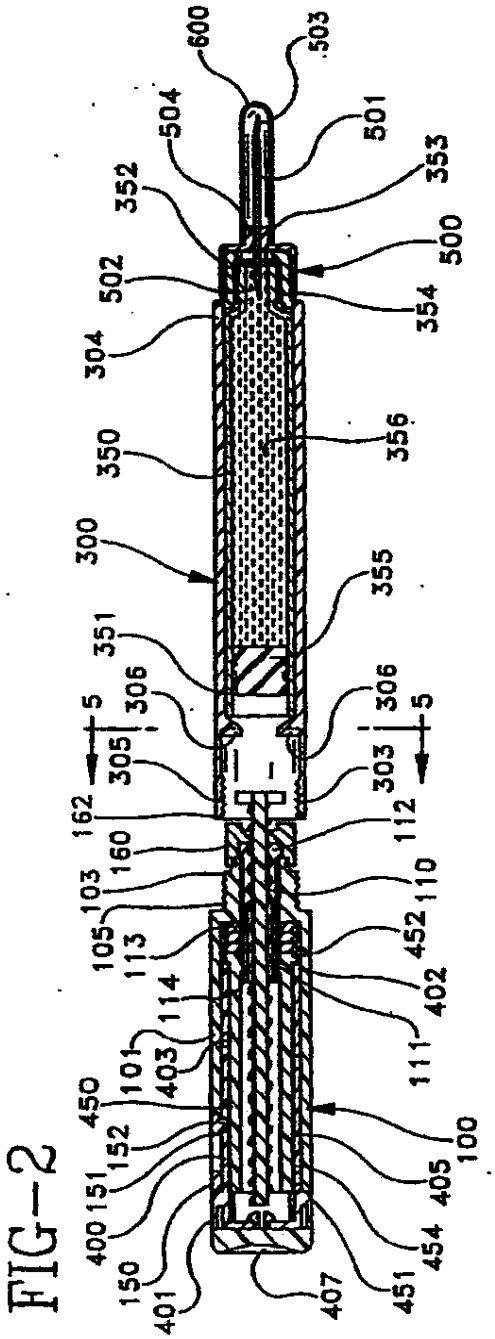

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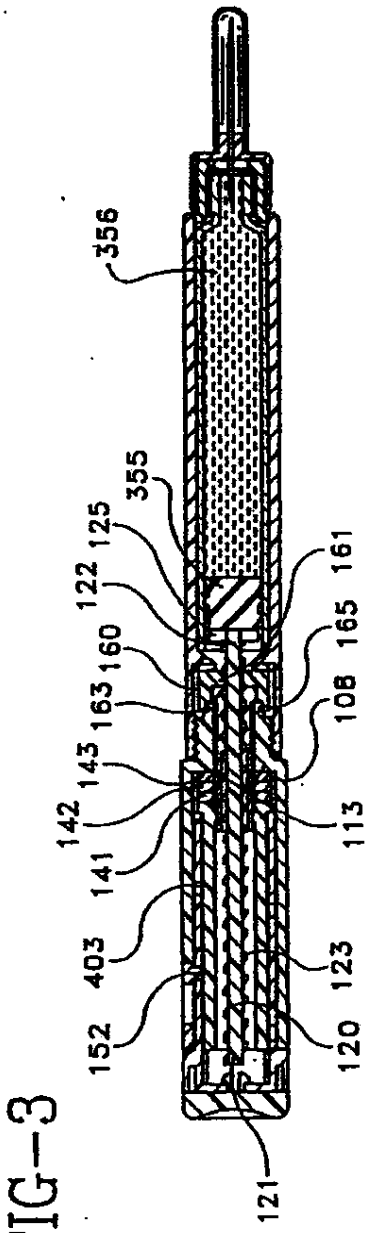
FIG-2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152
120
121

FIG-3

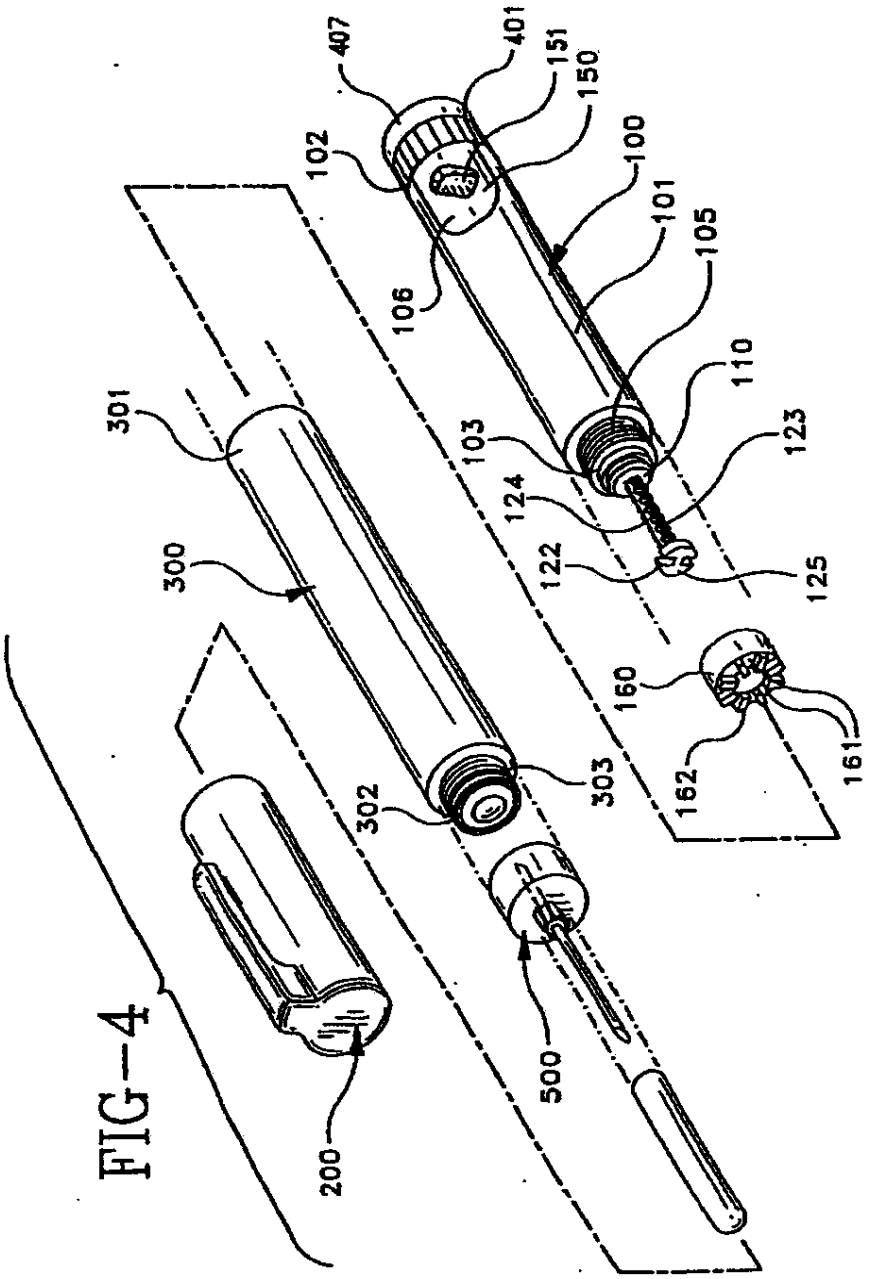
407
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FIG-4

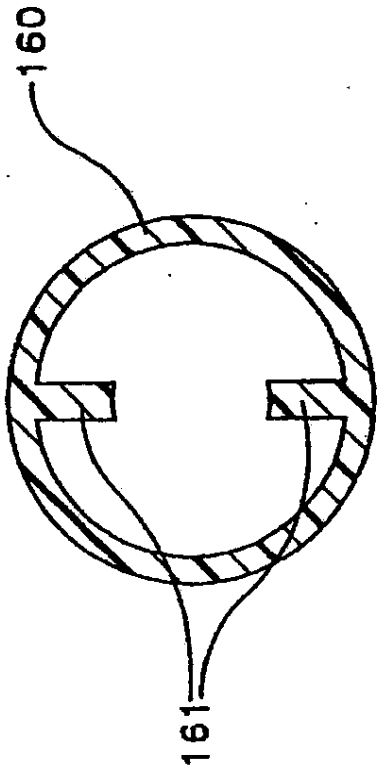

FIG-5

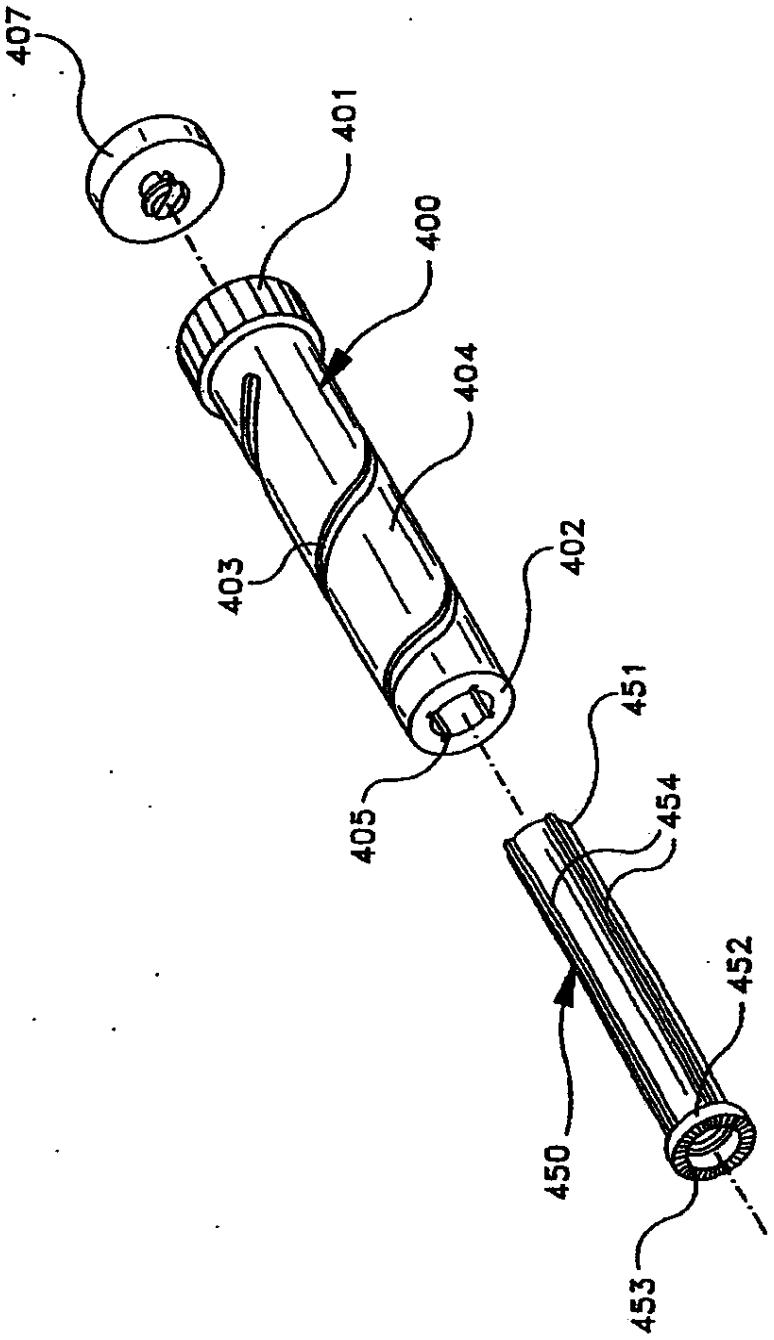

FIG-6

CARTRIDGE LOADING AND PRIMING MECHANISM FOR A PEN INJECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The subject invention relates to an improved cartridge loading and priming mechanism for a medication delivery pen having a cartridge holder assembly and a pen body assembly removably mounted to the cartridge holder assembly for delivering selected doses of medication.

2. Description of Related Art

Hypodermic syringes are used to deliver selected doses of medication to patients. The prior art hypodermic syringe includes a syringe barrel having opposed proximal and distal ends. A cylindrical chamber wall extends between the ends and defines a fluid receiving chamber. The proximal end of the prior art syringe barrel is substantially open and receives a plunger in sliding fluid tight engagement. The distal end of the prior art syringe barrel includes a passage communicating with the chamber. A needle cannula is mounted to the distal end of the prior art syringe barrel, such that the lumen of the needle cannula communicates with the passage and the chamber of the syringe barrel. Movement of the plunger in a proximal direction draws fluid through the lumen of the needle cannula and into the chamber. Movement of the plunger in a proximal-to-distal direction urges fluid from the chamber and through the lumen of the needle cannula.

Medication to be injected with the prior art hypodermic syringe often is stored in a vial having a pierceable elastomeric seal and accessed by piercing the elastomeric seal with the needle cannula. A selected dose of the medication may be drawn into the chamber of the syringe barrel by moving the plunger a selected distance in a proximal direction. The needle cannula is withdrawn from the vial, and the medication is injected into a patient by moving the plunger in a distal direction.

Some medication, such as insulin is self-administered. The typical diabetes patient will require injections of insulin several times during the course of the day. The required dose of insulin will vary from patient to patient, and for each patient may vary during the course of the day and from day to day. Each diabetes patient will establish a regimen that is appropriate for his or her own medical condition and for his or her lifestyle. The regimen typically includes some combination of a slow or medium acting insulin and a faster acting insulin. Each of these regimens may require the diabetes patient to periodically self-administer insulin in public locations, such as places of employment or restaurants. The required manipulation of the standard prior art hypodermic syringe and vial can be inconvenient and embarrassing in these public environments.

Medication delivery pens have been developed to facilitate the self-administration of medication. One prior art medication delivery pen includes a vial holder into which a vial of insulin or other medication may be received. The vial holder is an elongate generally tubular structure with proximal and distal ends. The distal end of the prior art vial holder includes mounting means for engaging a double-ended needle cannula. The proximal end also includes mounting means for engaging a driver and dose setting apparatus as explained further below. A disposable vial for use with the prior art vial holder includes a distal end having a pierceable elastomeric seal that can be pierced by one end of a double-ended needle cannula. The proximal end of this prior art vial includes a plunger slidably disposed in fluid tight engagement with the cylindrical wall of the vial. This prior art medication delivery pen is used by inserting the vial of medication into the vial holder. A prior art pen body then is connected to the proximal end of the vial holder. The pen body includes a dose setting apparatus for designating a dose of medication to be delivered by the pen and a driving apparatus for urging the plunger of the vial distally for a distance corresponding to the selected dose.

The user of the pen mounts a prior art double-ended needle cannula to the distal end of the vial holder such that the proximal point of the needle cannula pierces the elastomeric seal on the vial. The patient then selects a dose and operates the pen to urge the plunger distally to deliver the selected dose. The dose selecting apparatus returns to zero upon injection of the selected dose with this prior art medication delivery pen. The patient then removes and discards the needle cannula, and keeps the prior art medication delivery pen in a convenient location for the next required medication administration. The medication in the vial will become exhausted after several such administrations of medication. The patient then separates the vial holder from the pen body. The empty vial may then be removed and discarded. A new vial can be inserted into the vial holder, and the vial holder and pen body can be reassembled and used as explained above.

The above described reusable medication delivery pen is effective and much more convenient for self-administration of medication than the typical hypodermic syringe and separate medication vial. However, the disassembly of the pen to remove empty medication vials and to insert new ones is an inconvenience. As a result, disposable pens have been developed. The prior art disposable medication delivery pen includes a vial of insulin or other such medication permanently encapsulated therein. The patient need merely connect a double-ended needle cannula to the disposable pen for each administration of medication. The prior art disposable pen can be discarded when the supply of medication permanently encapsulated therein has been exhausted.

Disposable medication delivery pens offer certain conveniences to the patient who is required to self-administer medication. However, the dose selecting and driving mechanisms of prior art medication delivery pens are fairly complex devices and costly to manufacture. Hence, a substantial cost penalty is associated with the convenience of using a disposable medication delivery pen.

Another problem with the above-described medication delivery pens is in loading and priming the pens. These pens usually utilize a lead screw and matching nut combination that translate a rotary dose setting motion into a linear lead screw motion required to expel medication from the pen or cartridge. In such a mechanism, the nut is allowed to rotate during medication delivery while rotation of the lead screw is prevented by means of a rigidly mounted ring with tabs extending into the lead screw. Therefore, as the nut turns the pre-selected amount, threads on the nut and lead screw cause the lead screw to move axially to deliver the medication. Then, when the cartridge is empty and must be replaced, the fully extended lead screw must be manually rotated and returned to a starting position to receive a new cartridge. However, manual rotation of the lead screw is very difficult since the tabbed ring is intended to prevent rotation of the lead screw.

SUMMARY OF THE INVENTION

It is an objective of the present invention to overcome the problem with moving the lead screw back into the pen during cartridge loading found in prior art pens by providing

a medication delivery pen having an improved cartridge loading and priming mechanism that allows a patient to easily load and prime the pen. The present invention provides a pen with a lead screw that is easily slid back into the pen during cartridge loading and thereby eliminates the need for a patient to manipulate an anti-rotation tabbed ring. In the present invention the lead screw does not stop sliding until the cartridge holder assembly has been fully threaded onto the pen housing and, therefore, provides automatic priming of the pen during the threading operation and causes the lead screw to automatically engage with a drive mechanism.

In particular, the medication delivery pen of the present invention includes a medication cartridge holder assembly that is selectively engageable with and disengageable from a pen body assembly. In particular, the medication delivery pen includes means for allowing the lead screw in the medication delivery pen to automatically and easily slide into and prime the medication delivery pen as the cartridge assembly approaches the pen body assembly, when the lead screw is in contact with the plunger in the cartridge. The medication pen also includes means for engaging the lead screw to the cartridge holder assembly as the cartridge is being threaded to the pen body assembly and means for engaging the lead screw to the drive mechanism when the cartridge holder assembly has been fully threaded to the pen body assembly.

These and other aspects, features and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the medication delivery pen of the subject invention;

FIG. 2 is a longitudinal cross-sectional view of an unassembled medication delivery pen shown in FIG. 1 along lines 2—2;

FIG. 3 is a longitudinal cross-sectional view of an assembled medication delivery pen shown in FIG. 2;

FIG. 4 is a exploded perspective view of the medication delivery pen shown in FIG. 1;

FIG. 5 is a cross-sectional view of the medication delivery pen shown in FIG. 2 along lines 5—5; and FIG. 6 is a further exploded perspective view of dose knob 400 and driver 450, shown in FIG. 2.

DETAILED DESCRIPTION

A medication delivery pen in accordance with the subject invention is identified generally by the numeral 10 in FIGS. 1–4. Medication delivery pen 10, as shown in FIGS. 1–4, includes a reusable pen body assembly 100, a cap 200, a cartridge holder assembly 300, and a needle cannula assembly 500. Cartridge holder assembly 300 includes opposed proximal and distal ends 301 and 302, respectively. Proximal end 301 of cartridge holder assembly 300 is dimensioned and configured to threadedly engage pen body assembly 100, as explained further herein. Distal end 302 of cartridge holder assembly 300 is configured to securely but releasably engage needle cannula assembly 500.

The preferred embodiment of reusable pen body assembly 100 is illustrated in detail in FIGS. 2–4. It is understood, however, that variations from this preferred embodiment may be provided, and are considered to be within the scope of the subject invention. Reusable pen body assembly 100 includes a cylindrical housing 101 having opposed proximal and distal ends 102 and 103. An array of external threads 105 extends proximally from distal end 103 for threaded engagement with threads 303 in proximal end 301 of cartridge holder assembly 300. Portions of housing 101 adjacent distal end 103 are characterized by an array of clutch teeth (not shown) molded therein. Proximal end 102 of housing 101 is characterized by a cut-out 106 formed therein for receiving a window insert 150 having a window 151 and a button 152.

Pen body assembly 100 further includes a nut 110 having opposed proximal and distal ends 111 and 112, respectively. Exterior surface regions of nut 110 between proximal and distal ends 111 and 112 define a plurality of longitudinally extending splines 113. Proximal end 111 of nut 110 is characterized by a plurality of longitudinally extending resilient fingers 114 with enlarged ends that enable snap engagement of nut 110 into other portions of pen body assembly 100 as explained further herein. Distal end 112 of nut 110 is radially enlarged to limit axial movement of nut 110 into distal end 103 of housing 101. Thus, nut 110 is axially constrained within housing 101. However, the dimensions and configurations of nut 110 and housing 101 permit free relative rotation therebetween.

Pen body assembly 100 further includes a clutch assembly having a proximal clutch 141, a distal clutch 143 and an annular spring 142 biasingly engaged therebetween. Proximal and distal clutches 141 and 143 are both configured for non-rotatable engagement over splines 113 of nut 110. Distal clutch 143 includes an array of distally facing saw teeth (not shown) dimensioned, disposed and configured for engagement with the teeth (not shown) on interior surface 108 of housing 101, such that distal clutch 143 can rotate only in one direction relative to housing 101. Proximal clutch 141 includes an array of proximally facing teeth (not shown) which are also configured for unidirectional rotation as explained further herein.

Pen body assembly 100 further includes a drive mechanism having a generally cylindrical driver 50 with opposed proximal and distal ends 451 and 452. Driver 450 is slidably inserted into housing 101 of pen body assembly 100 such that distal end 452 of driver 450 is snap fit over the enlarged ends of resilient fingers 114 at proximal end 111 of nut 110. This snap fit engagement prevents axial movement between nut 110 and driver 450, but permits free relative rotational movement within housing 101. Distal end 452 of driver 450 is also characterized by an array of saw teeth (not shown) that engage with the saw teeth on proximal clutch 141. Outer surface regions of driver 450 are characterized by splines 454 extending radially outwardly thereon and along a substantial portion of the length of driver 450.

Pen body assembly 100 further includes a dose knob 400 which is a hollow generally cylindrical structure having opposed proximal and distal ends 401 and 402 and opposed inner and outer surfaces. As shown in FIG. 6, the inner surface is characterized by longitudinally extending grooves 405 which are disposed and dimensioned for engagement with splines 454 on driver 450. More particularly, dose knob 400 is spline mounted over driver 450 within housing 101 of pen body assembly 100. Thus, axially extending grooves 405 in dose knob 400 engage splines 454 of driver 450 to prevent relative rotation therebetween, but permitting relative axial movement. The outer surface of dose knob 400 is characterized by a helical groove 403 with dosage indicia to define dose amounts corresponding to different positions along helical groove 403. Proximal end 401 of dose knob 400 is characterized by a gnarled exterior surface to facilitate manipulation for setting a selected dose having an

actuator button 407 snapped therein to permit relative rotation therebetween.

Insert 150 is snapped into engagement with cut-out 106 in the proximal end 102 of housing 101. Insert 150 includes a window 151 therethrough and button 152 on an interior face that is dimensioned and disposed to engage with helical groove 403 on dose setting knob 400. Button 152 and window 151 are disposed to also enable the dosage indicia on dose setting knob 400 to be visible through window 151 as dose knob 400 is rotated.

Pen body assembly 100 includes a lead screw 120 with opposed proximal and distal ends 121 and 122 and an array of external threads 123. External threads 123 are characterized, however by a pair of opposed axially extending grooves 124 which extend from an enlarged head 125 at distal end 122 substantially to the proximal end 121. Threads 123 are threadably engaged in nut 110, such that proximal end 121 of lead screw 120 is within housing 101 and distal end 122 projects distally beyond housing 101. Threads 123 on lead screw 120 have exactly the same pitch and the same hand as threads 105 on distal end 103 of housing 101.

Pen body assembly 100 further includes an anti-rotation ring 160, shown in FIGS. 2-5, having a pair of tabs 161 extending therein and splines 162 on its distal surface. Each tab 161 slidable engages groove 124 on lead screw 120 to allow anti-rotation ring 160 to travel on and rotate with lead screw 120. Thus, lead screw 120 can slidably move relative to anti-rotation tabs 161, but is prevented from rotating relative to anti-rotation tabs 161.

Pen body assembly 100 is assembled by placing nut 110 into housing 101 from distal end 103. Clutch assembly 141,142 and 143 then is mounted over splines 113 on nut 110. Driver 450 is then inserted into proximal end 102 of housing 101, and is urged sufficiently in a distal direction for snap fit engagement with nut 110. In this snapped engagement, the saw teeth of distal clutch 143 will be secured in engagement with the teeth in of housing 101, and the saw teeth of proximal clutch 141 will be engaged with the saw teeth at distal end 452 of driver 450. Spring 142 will maintain constant selected pressure between these interengaged saw teeth. Insert 156 then is positioned over dose knob 400 such that button 152 of insert 150 is engaged in the helical groove 403 in dose knob 400. The temporarily assembled insert 150 and dose knob 400 then are into housing 101. Lead screw 120 then is threaded into nut 110, and actuator button 407 is snapped into engagement with proximal end 401 of dose knob 400. Finally, anti-rotation ring 160 is slid onto lead screw 120 and a retaining ring 163 on ring 160 is rotatably attached to a receiving ring 165 at distal end 103 of pen housing 101.

Cartridge holder assembly 300, shown in detail in FIGS. 2 and 3, includes a molded housing 304 which extends from proximal end 301 to distal end 302 of cartridge holder assembly 300. Housing 304 includes a mounting cavity 305 extending inwardly from proximal end 301. Mounting cavity 305 is characterized by an array of internal threads 303 for threaded engagement with external threads 105 on distal end 103 of housing 101. A set of splines 306 are located in proximal end 301 of cartridge holder assembly 300 to receive splines 162 on anti-rotation ring 160 when cartridge holder assembly 300 is threaded onto housing 101 to prevent cartridge holder assembly 300 from rotating with respect to lead screw 120 but continue to rotate with respect to pen housing 101. However, when pen 10 is fully assembled, splines 162 are fully engaged with splines 306 so that lead screw 120 is then engaged with the remaining drive mechanism in the pen and ready for dose setting and dispensing operations.

Cartridge holder assembly 300, further includes a medication cartridge 350 securely retained in housing 304 between proximal end 301 and distal end 302. Medication cartridge 350 includes an open proximal end 351 and a distal end 352 having a pierceable elastomeric seal 353 securely mounted therein. A cap 354 extends between housing 304 and cartridge 350 for securely and permanently holding medication cartridge 350 in housing 304. A plunger 355 is disposed in sliding fluid tight engagement in cartridge 350. As shown in FIG. 3, plunger 355 is disposed in primed contact with plunger 355 of medication cartridge 350 when fully threaded to cartridge holder assembly 300. Portions of cartridge 350 between plunger 355 and seal 353 are filled with a medication 356, such as insulin.

Needle cannula assembly 500 includes a double ended needle cannula 501 having opposed proximal and distal points 502 and 503, respectively, and a lumen extending axially therebetween. A mounting hub 504 is engaged on needle cannula 501 and is threadably engageable with cap 354 of cartridge holder assembly 300. The relative location of mounting hub 504 ensures that proximal point 502 of needle cannula 501 will pierce seal 353 when mounting hub 504 is engaged with cap 354. Needle cannula assembly 500 further includes a shield 600 removably mounted thereon for protecting against accidental needle sticks until immediately prior to use of pen 10.

As noted above, pen body assembly 100 is reusable and cartridge holder assembly 300 is disposable. More particularly, cartridge 350 in cartridge holder assembly 300 will contain a volume of medication 356 sufficient for administration of several doses. After exhaustion of the medication 356, cartridge holder assembly 300 will be threadedly disengaged from pen body assembly 100 and discarded. A new cartridge holder assembly 300 may then be mounted to the reusable pen body assembly 100.

To effect the mounting of a new cartridge holder assembly 300 to the reusable pen body assembly 100, the patient need merely advance distal end 122 of lead screw 120 into cartridge holder assembly 300 until distal end 122 of lead screw 120 engages plunger 355. Assembly continues by merely exerting axial forces on actuator button 407 and on cartridge holder assembly 300 Additionally, friction between plunger 355 and cartridge 350 and fluid forces exerted by medication 356 and seal 353 will prevent axial advancement of lead screw 120 beyond the position depicted in FIG. 3 during assembly. Additionally, the splined engagement of distal clutch 143 with nut 110 and the engagement of the teeth on distal clutch 143 with the corresponding teeth in housing 101 prevent independent rotation of nut 110 with respect to housing 101, during this initial mounting of reusable pen body assembly 100 with a new cartridge holder assembly 300. Therefore, axial forces exerted on actuator button 407 will cause housing 101 to rotate and advance towards cartridge holder assembly 300 as nut 110 rotates on threads 123 of lead screw 120.

After sufficient axial advancement, threads 105 at distal end 103 of pen body housing 101 will engage internal threads 303 at proximal end 301 of cartridge holder assembly 300. As noted above, external threads 105 at distal end 103 of housing 101 have exactly the same pitch and hand as threads 123 on lead screw 120. Hence, further axial forces exerted on actuator button 407 will cause the simultaneous threaded advancement of housing 101 along lead screw 120 and into cavity 305 at proximal end 301 of cartridge holder assembly 300. Because of the identical pitches, lead screw 120 will move proximally relative to pen body housing 101, while pen body housing 101 and cartridge holder assembly

300 are approaching their fully seated and threaded condition. When fully seated and threaded, lead screw 120 is fully engaged to the drive mechanism and can be driven by the drive mechanism when medication dispensing is desired.

The assembled reusable pen body assembly 100 and cartridge holder assembly 300 may be stored until a selected dose of medication is required. Just prior to use, a needle cannula assembly 500 may be threadedly engaged to distal end 302 of cartridge holder assembly 300. This threaded engagement will cause proximal point 502 of needle cannula 501 to pierce seal 353 and provide communication with medication 356. Shield 600 may then be removed.

A desired dose of medication 356 is then set by rotating dose knob 400 until indicia corresponding to the desired dose appears in window 151 of insert 150. The engagement of button 152 on insert 150 in helical groove 403 in dose knob 400 will cause a threaded retraction of dose knob 400 relative to housing 101 of reusable pen body assembly 100. This threaded retraction of dose knob 400 will cause a simultaneous rotation of driver 450 splined thereto. However, nut 110 will not rotate because the saw teeth on distal clutch 143 and the saw teeth on interior portions of housing 101 are locked to prevent rotation in that direction. Proximal clutch 141 is splined to nut 110, and hence also will not turn. However, saw teeth 453, shown in FIG. 6, at distal end 452 of driver 450 are shaped to allow rotation relative to proximal clutch 141 and provide an audible click for each unit of medication in the selected dose. This is helpful for visually impaired patients who may be required to set doses and administer insulin or other medication to themselves. Annular spring 142 contributes to the engagement that provides these audible clicking sounds.

When the desired dose is set, injection is achieved by merely pushing on actuator button 407. This causes dose knob 400 to turn about helix 403 relative to pen body housing 101, and driver 450 rotates through the same number of degrees. This rotation is opposite to the rotation generated by the dose setting procedure, and the rotational freedom of the clutch assembly 140 is reversed. Thus, as driver 450 turns the previously clicking proximal clutch 141 is locked to and turns with driver 450. This driving movement of proximal clutch 141 causes a corresponding rotational movement of nut 110 because of the splined engagement therebetween. Distal clutch 143 is now free to rotate against the saw teeth on housing 101, and makes an audible clicking indication during injection of medication.

Rotation of lead screw 120 is prevented by splines 306 unitary molded in cartridge holder assembly 300 mating with splines 162 on anti-rotation ring 160 engaged with lead screw 120 and causes lead screw 120 to be engaged with the drive mechanism. Therefore, as nut 110 rotates under the driving action of proximal clutch 141 and driver 450, lead screw 120 will be advanced axially into cartridge holder assembly 300. This axial advancement of lead screw 120 causes distal end 122 to urge plunger 355 distally into cartridge 350, and hence causes medication 356 to be injected through needle cannula 501. Injection will be terminated when proximal end 401 of dose knob 400 engages proximal end 102 of pen body housing 101.

Upon completion of the injection, needle cannula assembly 500 may be disengaged from cartridge holder assembly 300 and safely discarded. Cap 200 may be mounted over cartridge holder assembly 300, and pen 10 may be stored or carried in a convenient location until the next dose of medication is required. A subsequent dose of medication will be set in exactly the manner as described above. However, for such a subsequent dose, lead screw 120 and plunger 355 will be in a partly advanced position as a starting point. Dose setting and injections can be carried out until all of medication 356 has been used. Cartridge holder assembly 300 may then be threadedly disengaged from pen body assembly 100, and slidably separated from lead screw 120. The separated cartridge holder assembly may then be discarded and replaced as described above.

While the invention has been described with respect to a preferred embodiment, it is apparent that various changes can be made without departing from the scope of the invention as defined by the appended claims. In particular, the reusable pen body assembly may have other driving and/or clutch mechanisms. Additionally, different means for preventing and/or enabling rotation during the dose setting and injection phases may be provided. Similarly, other means for mounting needle cannula to the cartridge holder assembly may be provided. These various optional constructions will be apparent to those skilled in the an after having read the subject disclosure.

What is claimed is:

1. A medication delivery pen comprising:

a cartridge holder assembly for holding a cartridge having a plunger, said cartridge holder assembly having a plurality of threads at a proximal end; and

a pen body assembly releasably mountable on said cartridge holder assembly of said medication delivery pen for moving said plunger within said cartridge, said pen body assembly comprising:

a plurality of threads at a distal end for threading with said plurality of threads in said cartridge holder assembly;

a lead screw extending from the distal end for engaging the plunger in the cartridge in said cartridge holder;

means in said pen body assembly for driving said lead screw into said cartridge to move the plunger in the distal direction;

means in said pen body assembly for disengaging said driving means from said lead screw to permit said lead screw to automatically and easily retract into said pen body assembly as said pen body assembly approaches and is being threaded to said cartridge holder assembly; and

means in said pen body assembly for engaging said driving means to said lead screw to prime said medication delivery pen, when said pen body assembly is fully threaded onto said cartridge holder assembly,

wherein said means for disengagin and means for engaging include:

an anti-rotation ring slidably mounted on said lead screw to prevent said lead screw from rotating with respect thereto, said anti-rotation ring having a spline extending in the distal direction into said cartridge holder assembly; and

a spline located within said cartridge holder assembly for mating with said spline on said anti-rotation ring to prevent said lead screw from rotating with respect to said cartridge holder assembly and engage said lead screw to said driving means, when said pen body assembly is fully threaded onto said cartridge holder assembly.

2. A medication delivery pen according to claim 1, wherein said lead screw includes a longitudinal groove and said anti-rotation ring includes a tab that is received in said groove to prevent said lead screw from rotating with respect to said anti-rotation ring.

3. The medication delivery pen of claim 1, wherein said cartridge holder assembly further comprises a housing unitarily molded from a plastic material with said spline being a unitary portion of said housing.

4. A medication delivery pen according to claim 1, wherein:

said plurality of threads in said pen body assembly are dimensioned and have a pitch for threaded engagement with said plurality of threads at the proximal end of said cartridge holder assembly; and

said lead screw further comprises a proximal end disposed in said pen body assembly with an array of threads extending between the proximal end and the distal end of said lead screw and having a pitch substantially equal to said pitch of said plurality of threads in said pen body assembly.

5. The medication delivery pen of claim 1, wherein said pen body assembly further comprises dose setting means in said pen body assembly for defining specified distances of travel for said lead screw corresponding to selected doses of medication to be delivered.

6. The medication delivery pen of claim 1, further comprising a needle cannula assembly that is selectively engageable and disengageable from the distal end of said cartridge holder assembly.

7. A medication delivery pen comprising:

a cartridge holder assembly for holding a cartridge having a plunger, said cartridge holder assembly having a plurality of threads at a proximal end; and

a pen body assembly releasably mountable on said cartridge holder assembly of said medication delivery pen for moving said plunger within said cartridge, said pen body assembly comprising:

a plurality of threads at a distal end for threading with said plurality of threads in said cartridge holder assembly;

a lead screw extending from the distal end for engaging the plunger in the cartridge in said cartridge holder;

means in said pen body assembly for driving said lead screw into said cartridge to move the plunger in the distal direction;

means in said pen body assembly for disengaging said driving means from said lead screw to permit said lead screw to automatically and easily retract into said pen body assembly as said pen body assembly approaches and is being threaded to said cartridge holder assembly; and

means in said pen body assembly for engaging said driving means to said lead screw to prime said medication delivery pen, when said pen body assembly is fully threaded onto said cartridge holder assembly,

wherein said means for disengaging and means for engaging include:

an anti-rotation ring slidably mounted on said lead screw to prevent said lead screw from rotating with respect thereto, said anti-rotation ring having a plurality of splines extending in the distal direction into said cartridge holder assembly; and

a plurality of splines located within said cartridge holder assembly for mating with said plurality of splines on said anti-rotation ring to prevent said lead screw from rotating with respect to said cartridge holder assembly and engage said lead screw to said driving means, when said pen body assembly is fully threaded onto said cartridge holder assembly.

8. A medication delivery pen comprising:

a medication-containing cartridge holder assembly including:

an open proximal end having an array of threads,

a cartridge having a pierceably sealed distal end, and

a plunger in sliding fluid tight engagement within said cartridge at a location distally of said array of threads; and

a pen body assembly releasably mountable on said medication-containing cartridge holder assembly of said medication delivery pen for moving said plunger within said cartridge, said pen body assembly having:

a housing surrounding said pen body assembly and having opposed proximal and distal ends, said distal end having an array of threads dimensioned and having a pitch for threaded engagement with said array of threads at said proximal end of said medication-containing cartridge holder assembly,

a lead screw having a proximal end disposed in said housing, a distal end projecting beyond said distal end of said housing for selective engagement with said plunger, and an array of threads extending between said proximal and distal ends of said lead screw and having a pitch substantially equal to said pitch of said array of threads at said distal end of said pen body assembly,

driver means in said pen body assembly for moving said lead screw distally into said pen body assembly by preselected amounts,

dose setting means in said pen body assembly for defining specified distances of distal travel for said lead screw corresponding to selected doses of medication to be delivered and causing said driver means to move said lead screw distally a preselected amount corresponding to a selected dose, and

means in said pen body assembly for engaging said lead screw and said driver means and preventing said lead screw from moving in a proximal direction into said pen body assembly, when said pen body assembly is fully threaded onto said medication-containing cartridge holder assembly.

9. A medication delivery pen according to claim 8, wherein said means for engaging said lead screw and said driver means and preventing said lead screw from moving in a proximal direction into said pen body assembly include:

an anti-rotation ring slidably mounted on said lead screw to prevent said lead screw from rotating with respect thereto, said anti-rotation ring having a spline extending in the distal direction into said medication-containing cartridge holder assembly; and

a spline located within said medication-containing cartridge holder assembly for mating with said spline on said anti-rotation ring to prevent said lead screw from rotating with respect to said medication-containing cartridge holder assembly and engage said lead screw to said driver means, when said pen body assembly is fully threaded onto said medication-containing cartridge holder assembly.

* * * * *

NOVO NORDISK OF NORTH AMERICA, INC.
405 LEXINGTON AVENUE, SUITE 6400
NEW YORK, NEW YORK 10174-6401

Telephone: (212) 867-0123 FAX: (212) 878-9655

CORPORATE PATENTS

TELECOPY

Page 1 Of 4 Page(s).

Please Hand Deliver The Following To:

TO : Ex. Simens

CC :

FROM : Elms Lambos

DATE :

MESSAGE : Attached is a copy of the Response to the Restriction Requirement

IF ANY PROBLEMS OCCUR, PLEASE CALL
LOREN HERNANDEZ (212) 867-0123
Fax (212) 878-9655

Attorney Docket No.: 5533.200-US

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Buch-Rasmussen et al.

Serial No.: 09/349,748

Group Art Unit: 3763

Filed: July 8, 1999

Examiner: K. Simmons

For: Medical Device

CERTIFICATE OF FACSIMILE TRANSMISSION

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

I hereby certify that the attached correspondence comprising:

1. Response to Restriction Requirement

was sent to the United States Patent Office by telefax to the attention of Examiner K. Simmons, fax number (703) 305-3704 .

Respectfully submitted,

Date: March 6, 2000

Carol McFarlane
Novo Nordisk of North America, Inc.
405 Lexington Avenue, Suite 6400
New York, NY 10174-6401
(212)867-0123

Attorney Docket No.: 5533.200-US

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Buch-Rasmussen et al.

Application No.: 09/349,748 Group Art Unit: 3763

Filed: July 8, 1999 Examiner: K. Simmons

For: Medical Device

RESPONSE TO RESTRICTION REQUIREMENT

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

This paper is being filed in response to the Office Action mailed February 15, 2000, which made a restriction requirement between the following Groups:

Group I – claims 1-12 drawn to medication delivery devices, and

Group II – claims 13-18 drawn to cartridge assemblies.

In response to this requirement, Applicants hereby elect with traverse Group I. Applicants hereby reserve the right to file continuing applications directed to the nonelected subject matter.

The basis for traverse is that there would not be a serious burden on the examiner if restriction were not required. Each of the designated inventions is classified in Class 604, subclass 232.

The Examiner is hereby invited to contact the undersigned by telephone if there are any questions concerning this response or application.

Respectfully submitted,

Date: March 6, 2000

Elias J. Lambiris, Reg. No. 33,728
Novo Nordisk of North America, Inc.
405 Lexington Avenue, Suite 6400
New York, NY 10174-6401
(212) 867-0123

MAR. 6.2000 10:49AM NNNA NO.398 P.4/4

P. 1

* * * COMMUNICATION RESULT REPORT (MAR. 6.2000 12:15PM) * * *

TTI NNNA

FILE MODE	OPTION	ADDRESS (GROUP)	RESULT	PAGE
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REASON FOR ERROR
E-1) HANG UP OR LINE FAIL
E-2) BUSY
E-3) NO ANSWER
E-4) NO FACSIMILE CONNECTION

RESTRICTION ELECTION FACSIMILE TRANSMISSION

DATE: March 6, 2000

FROM/ATTORNEY: Elias Lambiris, Esq.

FIRM: Novo Nordisk of North America, Inc.

PAGES, INCLUDING COVERSHEET: (3)

PHONE NUMBER: (212) 867-0123

TO EXAMINER: Examiner K. Simmons

ART UNIT: Art Unit 3763

SERIAL NUMBER: 09/349,748

FAX/TELECOPIER NUMBER: (703) 305-3704

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/349,748	07/08/99	BUCH-RASMUSSEN	T 5533.200-US

EXAMINER	
SIRMONS, K	
ART UNIT	PAPER NUMBER
3763	9

DATE MAILED: 12/07/00

QM12/1207

STEVE T. ZELSON ESQ
NOVO NORDISK OF NORTH AMERICA INC
SUITE 6400
405 LEXINGTON AVENUE
NEW YORK NY 10174-6400

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)
*U.S. GPO: 2000-473-000/44602

1- File Copy

Office Action Summary

Application No.	Applicant(s)
09/349,748	Buch-Rasmussen et al
Examiner	**Group Art Unit**
Kevin C. Simons	3763

☒ Responsive to communication(s) filed on *Jul 8, 1999*

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

☒ Claim(s) *1-12* is/are pending in the applicat

Of the above, claim(s) _____ is/are withdrawn from consideration

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *1-12* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 7

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

— SEE OFFICE ACTION ON THE FOLLOWING PAGES —

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As to claim 1, it is unclear what is meant by "and the device further comprises means for securing that the plunger means abuts on the stopper during use of the device".

As to claims 3, the language is awkward and the examiner is unclear as to what the applicant is trying to claim.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-7 and 10-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Reynolds U.S. Pat. No. 5,364,369.

Reynolds discloses a medication delivery device comprising: a cartridge assembly (6), having one end sealed with a pierceable sealing (5), said end of the cartridge assembly comprising means for releasable mounting a needle assembly (4), and comprising a cartridge having a stopper (8) adapted to receive plunger means (10 and/or 14, it is the examiner's position that 10 and/or 14 are considered to be the plunger means), a dosing assembly (B) comprising plunger means (14 acts as a plunger), and optionally a needle assembly (note: Optionally a needle assembly is given no patentable weight, furthermore, it is not positively recited.), wherein the cartridge assembly and the dosing assembly are coupled together (note: (8) is a part of the cartridge (6), therefore, (10/14) which are considered to be the plunger means engages the cartridge assembly (6)), and the device further comprises means for securing that the plunger means abuts on the stopper during use of the device (figs. 1 and 2); wherein the dosing assembly is releasably coupled to the cartridge assembly (figs. 1 and 2); wherein the device is arranged for securing the plunger means abuts on the stopper during coupling and/or decoupling of the needle assembly (10 and 14); wherein the plunger means comprises a rod element (44); wherein the means for releasably coupling the dosing assembly and the cartridge assembly together are such that the coupling and/or decoupling of the needle assembly does not cause an axial movement of the cartridge assembly with respect to the dosing assembly (figs 1 and 2); wherein the dosing assembly is released from the cartridge assembly through a movement including an axial movement (B); wherein the dosing assembly is released form the cartridge assembly through a threaded coupling

(20); wherein the cartridge assembly comprises a housing (6); wherein the cartridge is unitarily moulded with at least one coupling means (6); further comprising a cap (4).

5. Claims 1, 8 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Chanoch U.S. Pat. No. 5,688,251.

Chanoch discloses a medication delivery device comprising: a cartridge assembly, having one end sealed with a pierceable sealing, said end of the cartridge assembly comprising means for releasable mounting a needle assembly, and comprising a cartridge having a stopper adapted to receive plunger means a dosing assembly comprising plunger means, and optionally a needle assembly (note: Optionally a needle assembly is given no patentable weight, furthermore, it is not positively recited.), wherein the cartridge assembly and the dosing assembly are coupled together and the device further comprises means for securing that the plunger means abuts on the stopper during use of the device (figs. 1-4); wherein the dosing assembly comprises scale means (col. 4. Lines 51-65); and wherein the dosing assembly comprises dose setting means for defining specified selected doses of medication to be delivered (400).

Conclusion

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Kevin C. Sirmons whose telephone number is (703)306-5410.

The examiner can normally be reached on Monday - Thursday from 6:30 am to 4:00 pm. The examiner can also be reached on alternate Fridays.

KCS

Kevin C. Sirmons

Patent Examiner

11/16/00

RICHARD K. SEIDEL
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3700

FORM PTO-892 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

NOTICE OF REFERENCES CITED

SERIAL NO.	GROUP ART UNIT	ATTACHMENT TO PAPER NO.	
09349748	3763		9

APPLICANT(S): Buch-Rasmussen et al

U.S. PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	NAME	CLASS	SUB-CLASS	FILING DATE
	A	5,364,369	11/1994	Reynolds	604	187	
	B	4,865,591	9/1989	Sams	604	186	
	C						
	D						
	E						
	F						
	G						
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FOREIGN PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUB-CLASS
	L						
	M						
	N						
	O						
	P						
	Q						

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

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EXAMINER	DATE
Kevin C. Sirmons	November 16, 2000

Form892ccs2106b

* A copy of this reference is not being furnished with this office action.
(See Manual of Patent Examining Procedure, section 707.05(a).)

US005364369A

United States Patent [19]

Reynolds

[11] Patent Number: 5,364,369

[45] Date of Patent: Nov. 15, 1994

[54] SYRINGE

[76] Inventor: David L. Reynolds, 305 Knowlton Road, P.O. Box 600, (Knowlton) Lac Brome, Quebec, Canada, J0E 1V0

[21] Appl. No.: 791,399

[22] Filed: Nov. 14, 1991

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 437,203, Nov. 16, 1989, Pat. No. 5,137,511, which is a continuation-in-part of Ser. No. 72,015, Jul. 8, 1987, Pat. No. 4,886,495.

[30] Foreign Application Priority Data

Nov. 14, 1990 [GB] United Kingdom 9024710.7

[51] Int. Cl.[5] A61M 5/00

[52] U.S. Cl. 604/187; 604/88; 604/191; 604/416

[58] Field of Search 604/82, 87, 88, 89, 604/91, 92, 191, 187, 200, 201, 203–205, 411, 413–416, 905; 206/222; 215/247

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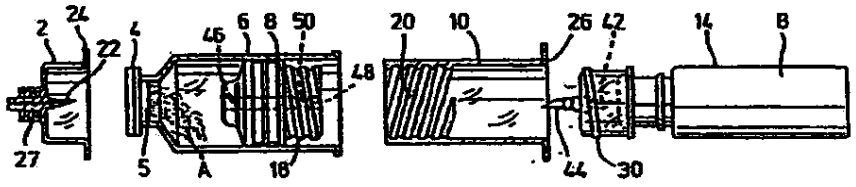
Primary Examiner—Ralph A. Lewis

Attorney, Agent, or Firm—Ridout & Maybee

[57] ABSTRACT

A prefilled syringe for one or two component medicaments is based upon the use of a vial containing a medicament or one component of a medicament, the vial having an open bottom closed by a piston. When a flexible extension of the piston is coupled with a tubular plunger, and an adaptor cap having an internal needle and an external connection for a needle is placed over a cap of the vial, the latter is converted into a prefilled syringe. The piston may have an axial passage closed by a resealable septum, so that a separate diluent stored in a flexible capsule may be introduced into the vial through the piston by a double ended needle mounted on a further cap applied to the capsule, the further cap being coupled within the tubular interior of the plunger so that the double ended needle penetrates the septum in the piston. The capsule is pushed forward onto the double ended needle when its contents are to be expelled into the vial. The capsule and its cap are then removed and discarded. In an alternative arrangement, the cap of the capsule is coupled to the adaptor cap and the diluent introduced into the vial through a closure secured by the cap of the vial, after which the capsule is removed from the plunger and the latter is coupled to the piston. In further embodiments, the capsule is replaced by a shell vial. The open bottom of the vial is formed with a strengthening bead designed not to interfere with handling of the vials by conventional vial sterilizing, filling and capping machinery.

2 Claims, 14 Drawing Sheets



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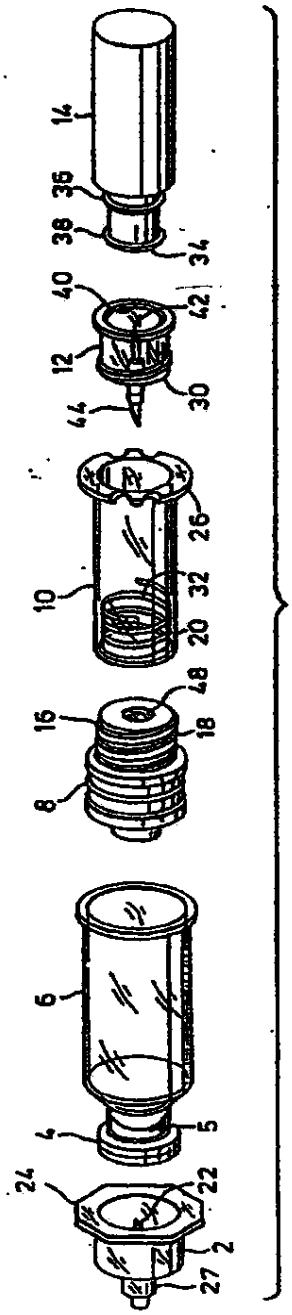
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FIG. 1

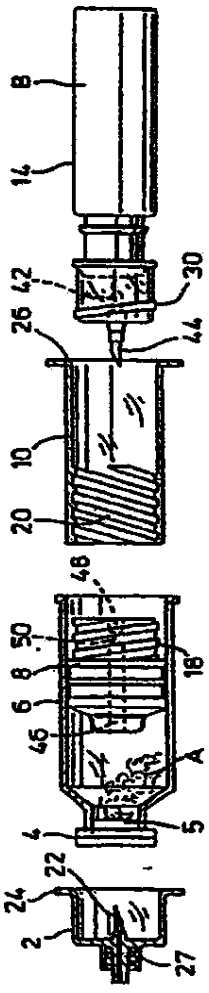
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FIG. 2

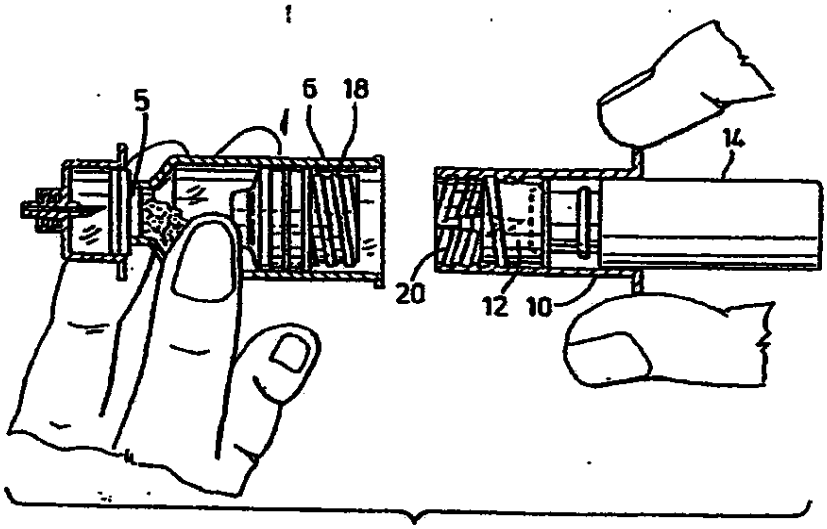


FIG. 3

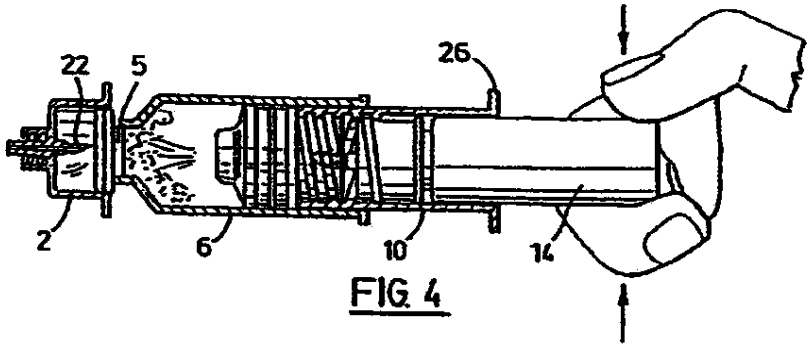


FIG. 4

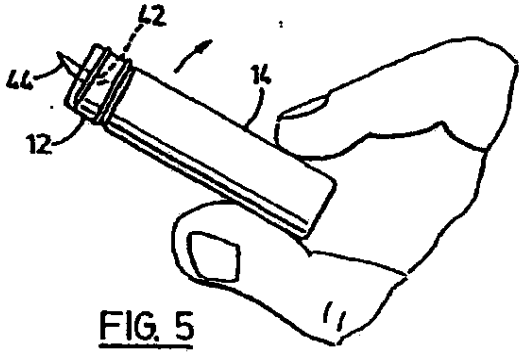


FIG. 5

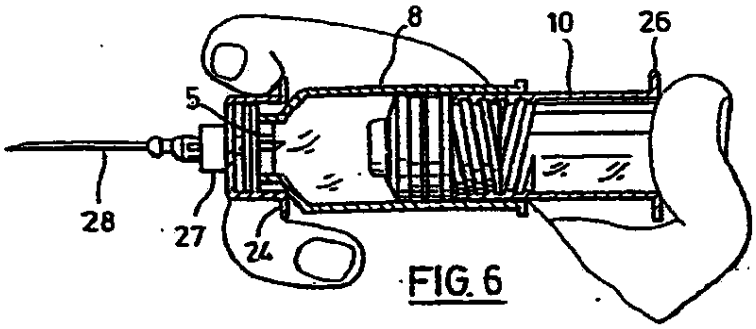


FIG. 6

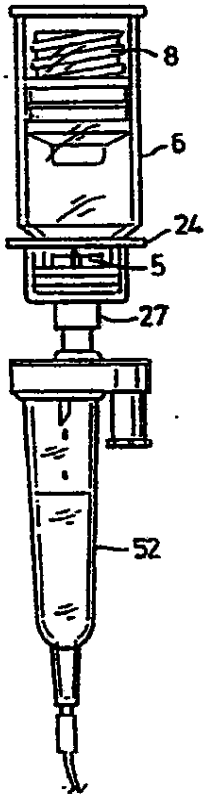


FIG. 7

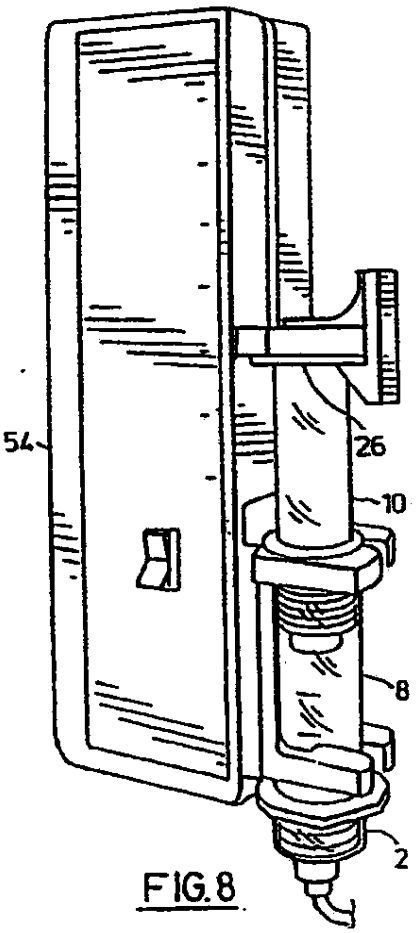
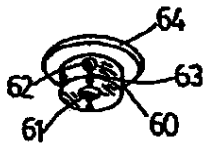


FIG. 8

FIG. 9



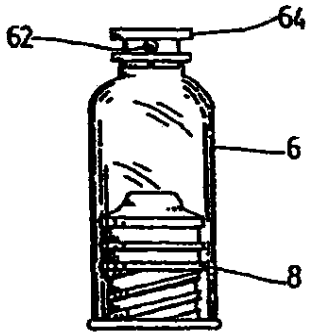


FIG. 10

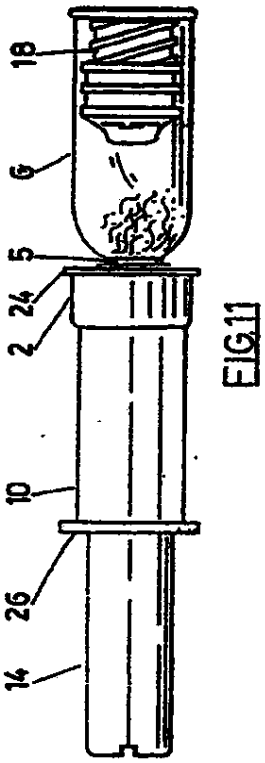


FIG.11

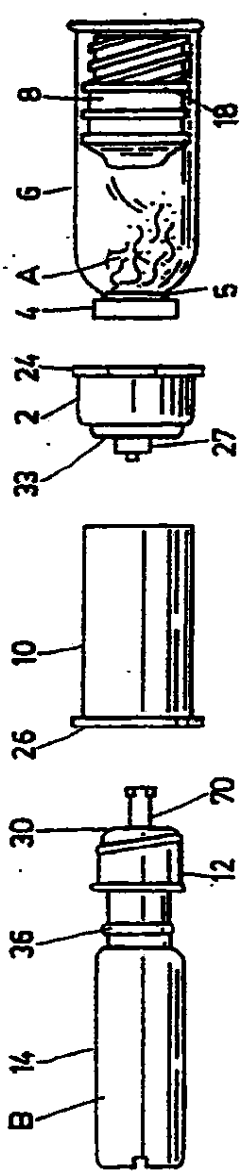


FIG.12

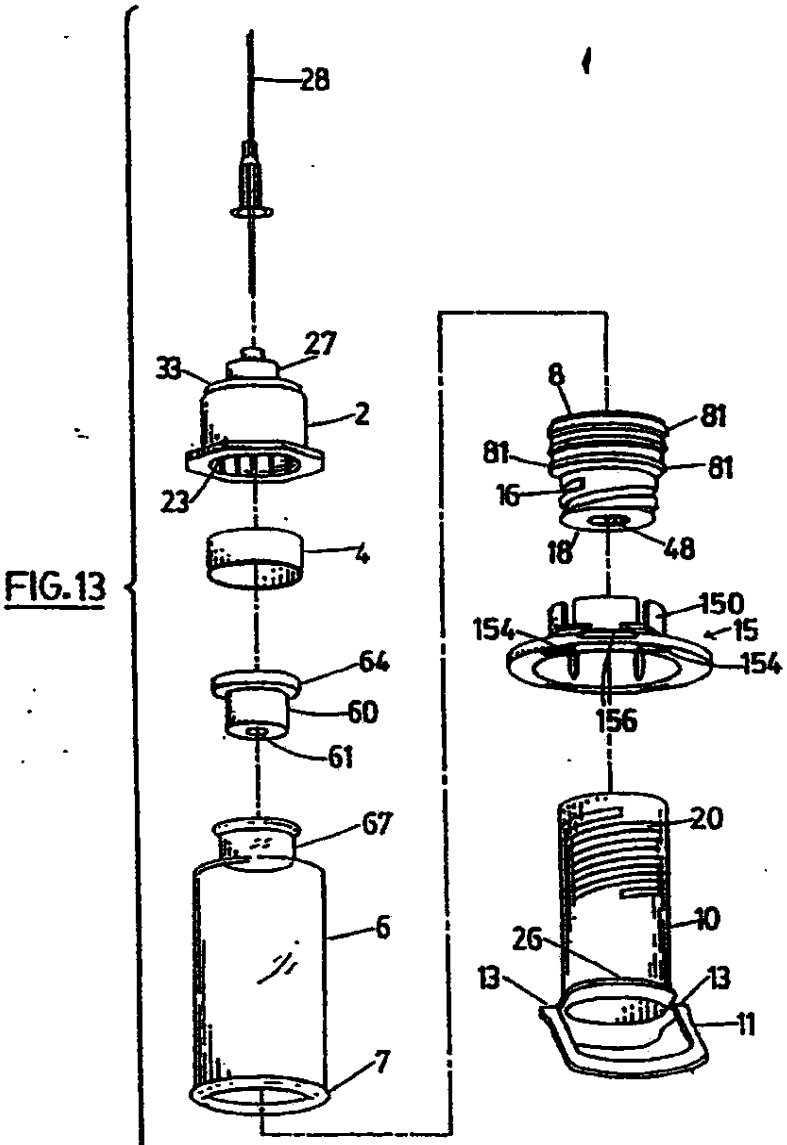

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FIG.13

FIG.13

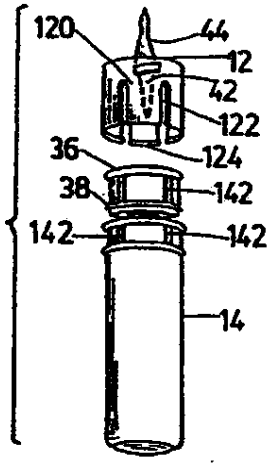
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FIG. 14

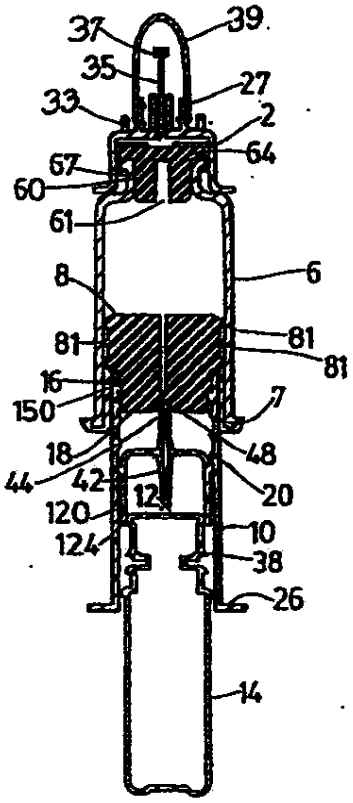
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FIG. 15

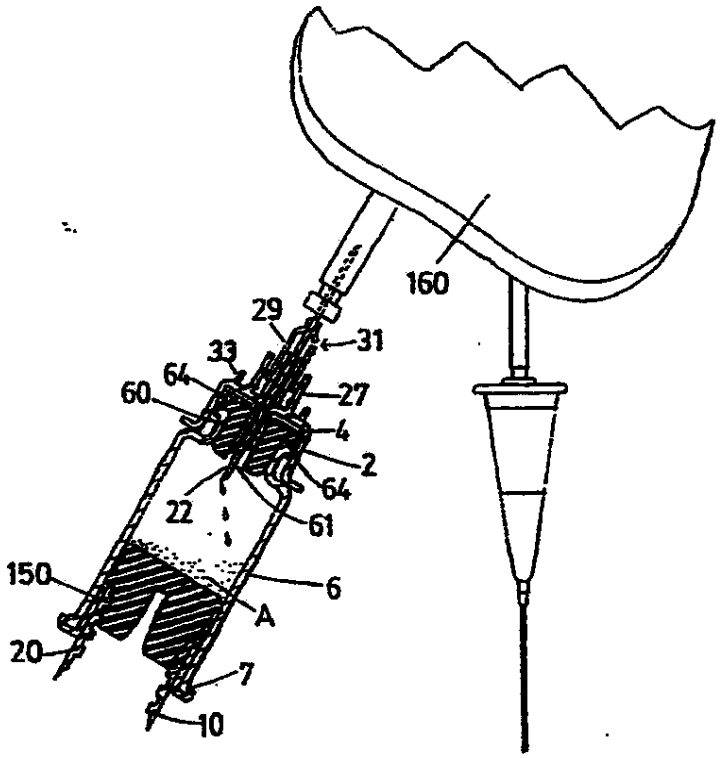

FIG. 16

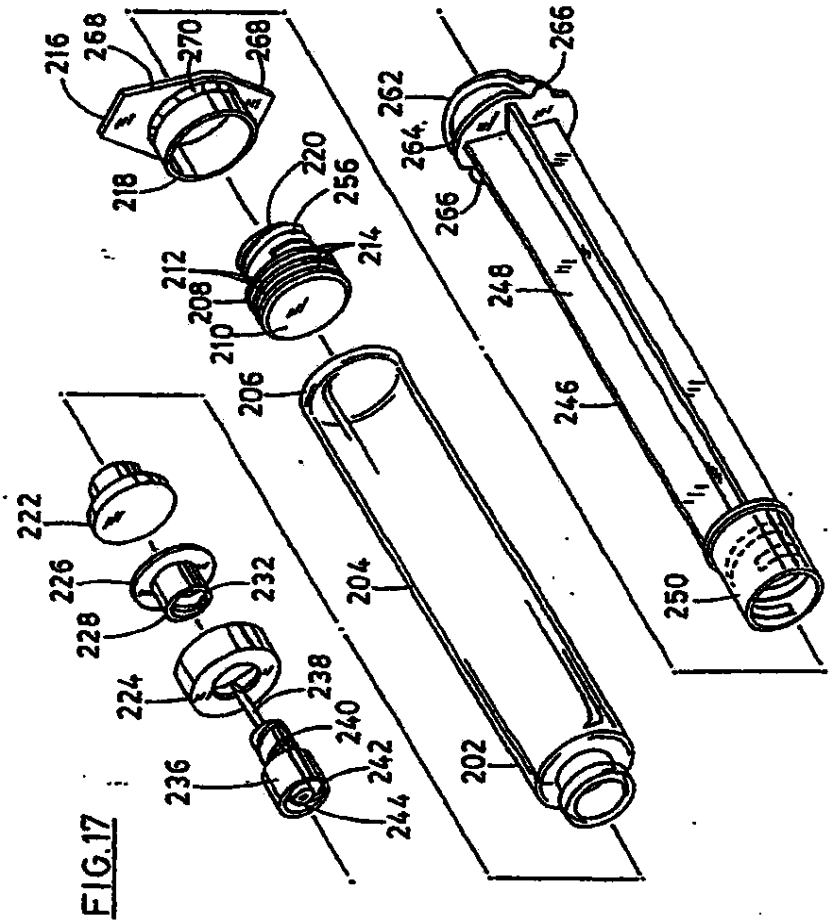
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FIG.17

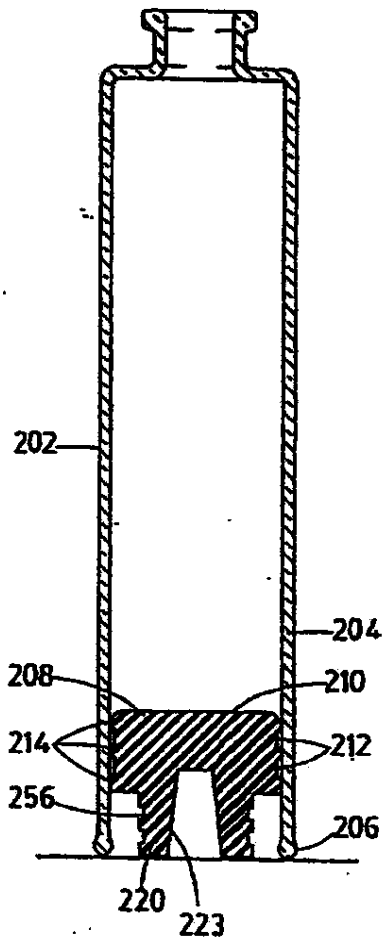
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FIG.18

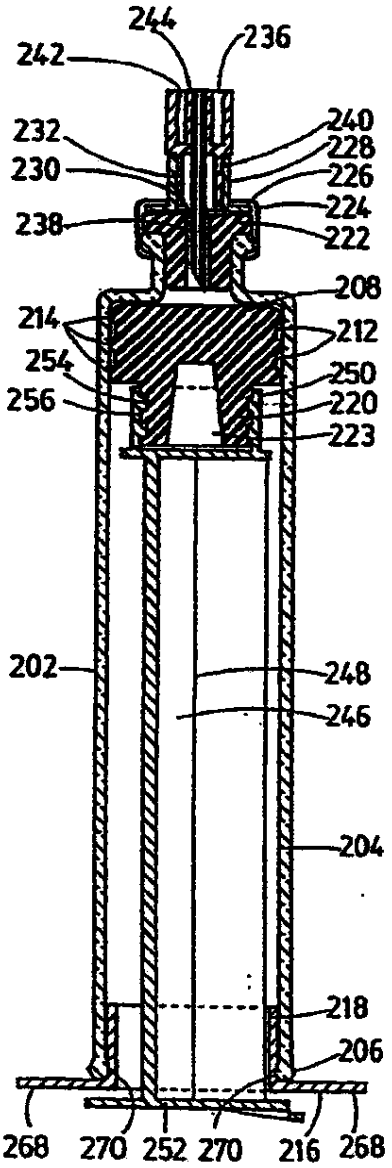
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FIG.19

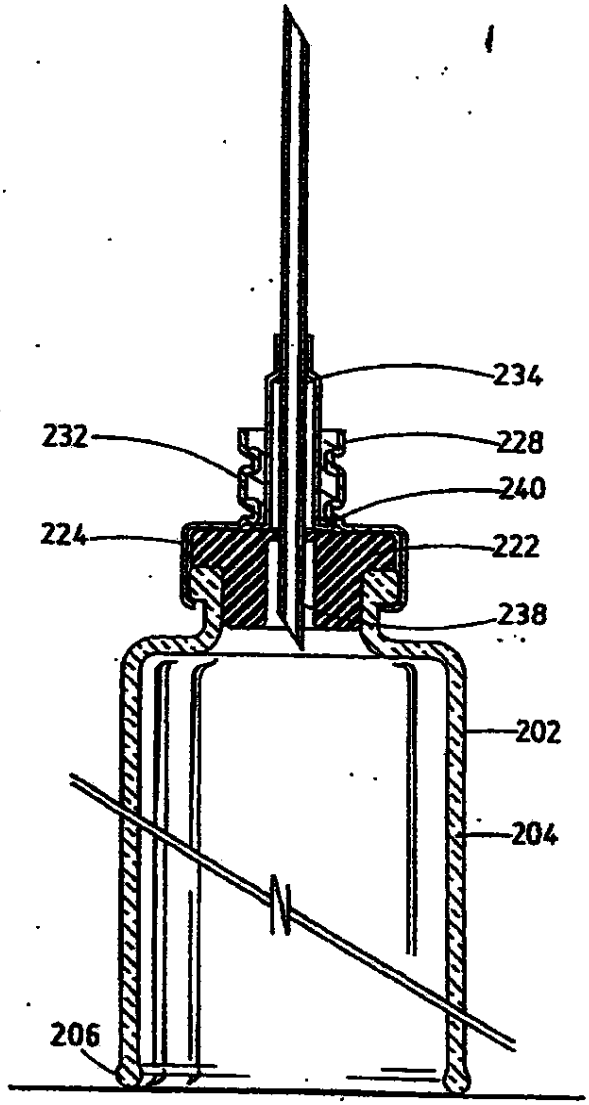

FIG.20

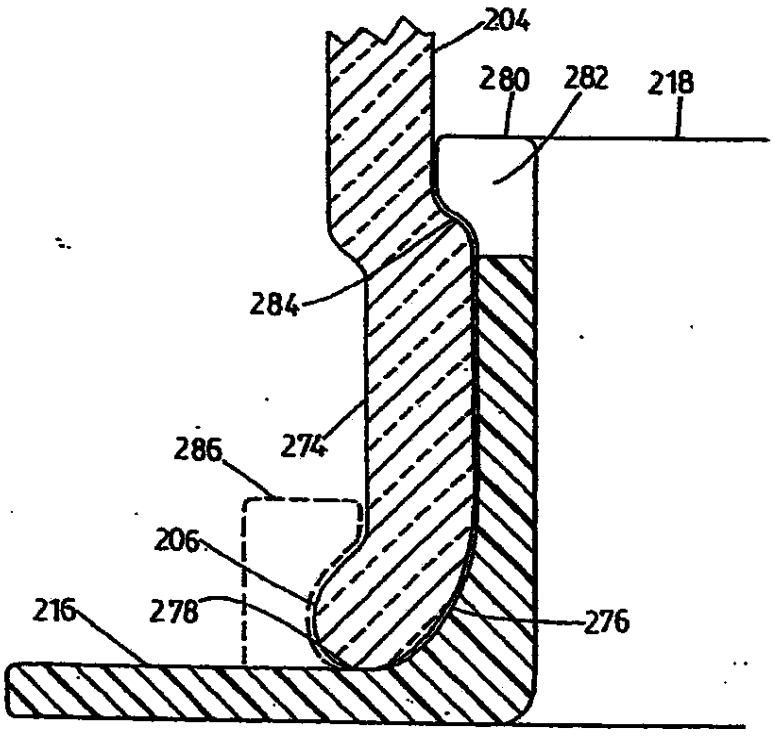

FIG.21

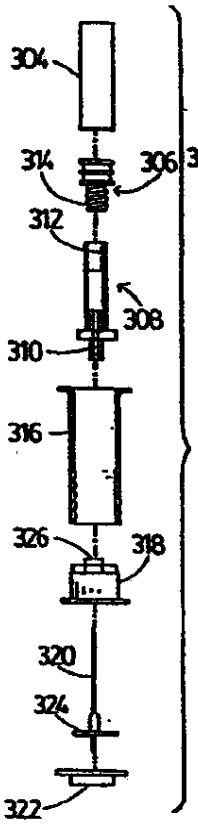

FIG. 22A

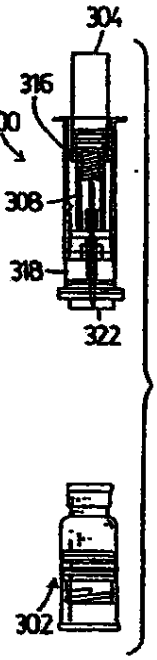

FIG. 22B

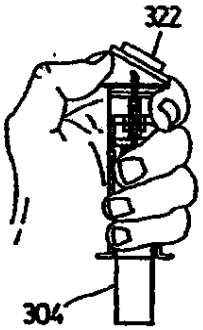

FIG. 22C

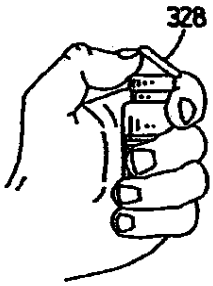

FIG. 22D

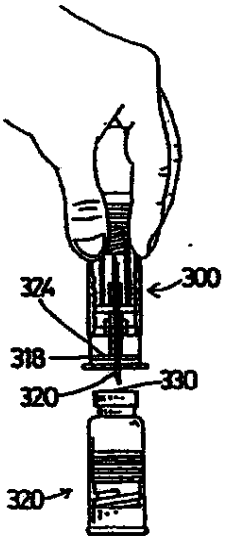

FIG. 22E

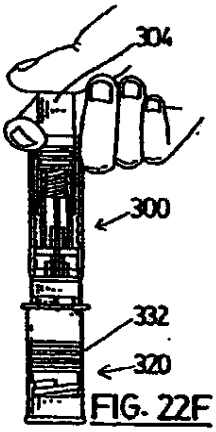

FIG. 22F

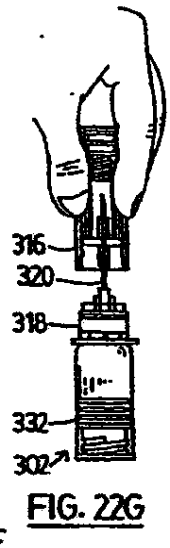

FIG. 22G

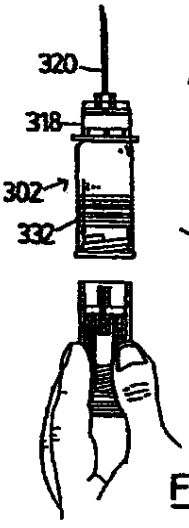

FIG. 22H

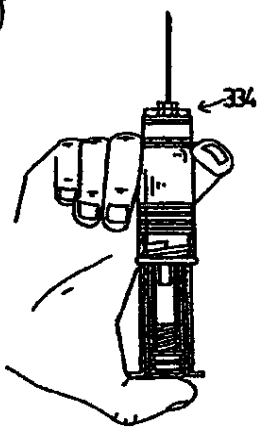

FIG. 22I

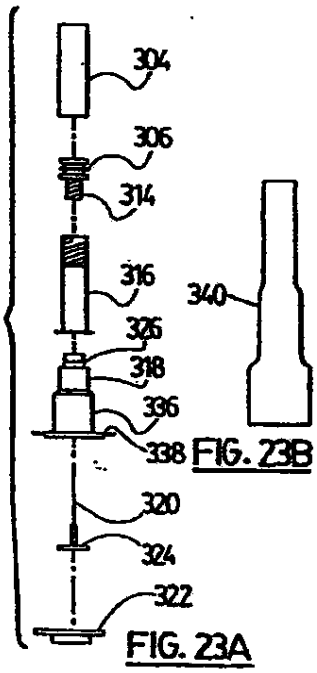

FIG. 23A

FIG. 23B

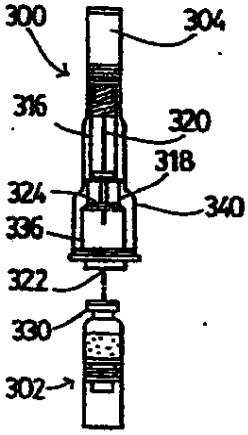

FIG. 23C

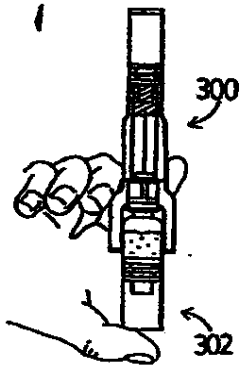

FIG. 23D

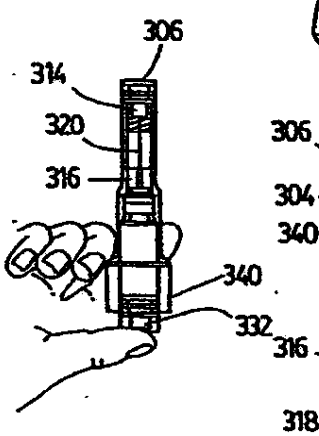

FIG. 23E

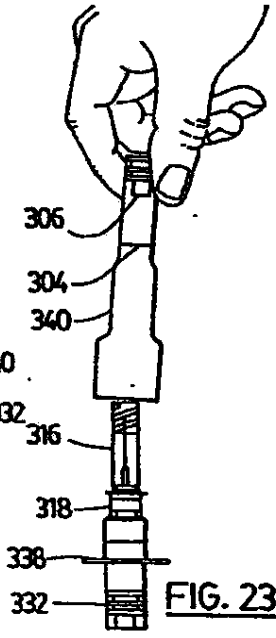

FIG. 23F

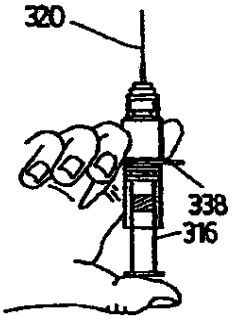

FIG. 23G

SYRINGE

REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of my co-pending application Ser. No. 07/437,203 filed Nov. 6, 1989, and now U.S. Pat. No. 5,137,511 which is a continuation-in-part of application Ser. No. 07/072,015 filed Jul. 8, 1987 and now U.S. Pat. No. 4,886,495.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to prefilled syringes for use in medical or veterinary treatment.

2. Review of the Art

There has been an increasing trend in recent years to the putting up of pharmaceuticals in dosage forms so as to minimize the preparation required to administer a medicament to a patient and to reduce the chances of dosage errors or contamination. One dosage form which has been gaining rapid acceptance is the prefilled disposable syringe. Various difficulties are however associated with the preparation and usage of such syringes, particularly in the case of preparations which, in ready to use condition, have a short shelf life. Numerous forms of dual compartment syringe structures have been proposed for the shipping of such preparations with components stored in separate compartments for admixture immediately prior to use. Although certain structures have met with some degree of acceptance, they are commonly difficult to manufacture and/or use because of difficulties in filling the syringe with the components, and because they require extensive manipulation immediately prior to use. Moreover they are frequently substantially more bulky than conventional syringes because in many cases they frequently comprise components which effectively represent two syringes in tandem.

Problems in the manufacture of prefilled syringes are not confined to two component systems and even with single component systems the filling of syringes under factory conditions is difficult to mechanize effectively and requires expensive special purpose syringe filling machinery. The same applies to related units prefilled with liquids required for injection or infusion during medical procedures.

Another approach where single component systems are involved is exemplified by British Patent Specifications Nos. 1,252,306 and 1,444,119, and U.S. Pat. No. 4,445,895, in which a prefilled cartridge having a displaceable plug at one end, and a needle penetrable closure at an opposite end, is inserted into the barrel of a syringe for dispensing of its contents. Whilst such cartridges and the equipment for filling them are known and available, they are only really suitable for preparations which can be stored in liquid form, and require either a special or a modified syringe for their use. The cartridges themselves require special filling apparatus.

In a further arrangement disclosed in U.S. Pat. No. 3,845,763, a cartridge or vial is closed at its bottom end by a slidable plug with a downwardly extending stem, which cartridge or vial is inserted bottom end first into a special holder which carries a double ended needle, so that the stem is penetrated by the needle and the body of the vial is converted into a plunger which can be depressed to expel the contents of the vial through the stem. The projecting stem means that the vial cannot be filled utilizing conventional vial filling machinery.

The high capital expenditure involved in implementing known prefilled syringe systems has severely limited their adoption to those few cases where their advantages outweigh the substantial additional unit costs involved as compared to conventional modes of delivery.

SUMMARY OF THE INVENTION

The present invention seeks to provide a system for the distribution of preparations required for injection or infusion in liquid dosage form during medical procedures, which has a wide range of utility both for single component liquid preparations or for two component systems of which one component may be a solid, which utilizes a small number of components all suitable for mass production using material already approved for usage in such applications, which is simple to assemble and can be filled utilizing equipment already available to most pharmaceutical manufacturers, which minimizes the number of "clean room" operations required, and which minimizes certification problems.

The system is based upon and built around a basic component in the form of a "bottomless vial". Such a bottomless vial has all of the characteristics of a conventional pharmaceutical vial, except that the glass base of the vial is replaced by a piston wholly received within the vial and designed to form a hermetic seal with its cylindrical side wall, the seal being maintained both when coupled and when uncoupled from a plunger releasably connectable to the piston for moving the latter axially of the vial. A particularly important characteristic of such a bottomless vial is that it can be conveyed, filled and capped reliably by conventional vial sterilization, filling and handling equipment such as is already possessed by most pharmaceutical manufacturers. To this end, the bottomless vial must be free of features which would significantly compromise its stability when handled by such equipment. A flange or bead is required around the base of the vial for various reasons, but must result in no more than a slight increase in the overall diameter of the vial, and must be configured so as to avoid any substantial increase in its tendency to tip when jostled by other similar vials, and the centre of gravity of the vial must not be displaced so far upwardly as to substantially reduce the stability of the vial.

I have found that it is important that the bottom end of such a bottomless vial terminates in a somewhat rounded peripheral bead, which serves several purposes. Firstly, it strengthens the open end of the vial and reduces stress concentrations and the risk of breakage, particularly during insertion of the piston. Secondly, the rounding produces a slight internal flare which facilitates piston insertion. Thirdly, it provides means for securely engaging a subsequently applied piston retainer which prevents possible ejection of the piston during shipping and storage of the vial due to gas generation or expansion within the hermetically sealed vial above the piston.

Whilst the provision of such a bead is thus highly desirable, conventional formation of the bead as an external projection on the body has the disadvantage increasing the diameter of the bottom of the body, thus both increasing the capability of tipping of the vials while being conveyed, and possibly providing a ramp for such tripping by riding over or under the beads of

adjacent vials unless the external configuration of the bead is carefully controlled. At the same time, particularly for syringes prefilled with a single component liquid pharmaceutical, there may be a requirement for a syringe capacity which requires the height to diameter ratio of the body to be increased as much as possible, which in turn requires maximum stability of the vial when conveyed free-standing.

The piston must be capable of maintaining a hermetic seal with the wall of the vial, of integrity comparable to that achieved during capping of a conventional vial, and this seal should be maintained in storage and during manipulation of a syringe system incorporating the vial, during which the piston may be subject to non-axial forces transmitted to it by a plunger and tending to break the seal.

In the context of the invention, it should be understood that "vial" refers to a particular type of container, having a rather squat cylindrical body whose height compared to the diameter of its base is such that it may stand stably on its base whilst being conveyed through a vial handling and filling machinery and whilst subsequently sealed and capped. Its body should also be free of external projections large enough to interact with other vials or the filling machinery in a manner such as to promote tipping. A vial has a neck with a large enough internal diameter to permit filling from a vial filling machine: solid filling materials will normally require a larger neck than liquids. Vials should not be confused with cartridges, which are comparatively long and slim, and cannot usually be filled utilizing vial filling machinery since they are too tall to rest in a stable manner on their bases. Cartridges also are typically thin-walled and lack a bead or flange, which renders them fragile, and makes it difficult to insert a piston without excessive risk of breakage.

Accordingly the present invention provides a vial formed of rigid transparent material and consisting of a cylindrical body, said body having an open bottom end having an external diameter at most only slightly greater than that of the remainder of the body, but sufficient relative to the height and centre of gravity of the vial as a whole to support the latter in a stable manner when conveyed standing on its open end through vial filling and capping machinery, injectable material within the body, a comparatively wide neck at the top of the body through which said injectable material is filled into the body, an external peripheral flange surrounding the neck, an elastomeric closure applied to the neck, a cylindrical cap clamped onto the flange of the neck and having an annular inward extending flange at a top end overlaying the closure to secure the closure to the neck with the closure presenting a needle penetrable central portion, an impervious substantially solid piston of resilient material sealingly received within said body at its lower end beneath said injectable material and above said open bottom end, and an extension integral with said piston, projecting downwardly from said piston but wholly within the body, for establishing a flexible connection to a syringe plunger in a zone between the piston and said open end of the body, whereby said vial may be converted into a syringe for ejection of the injectable material on movement of the piston towards the neck, by connection of said syringe plunger to said extension and connection of fluid conduit coupling means to said cylindrical cap.

According to a further feature of the invention, a vial for forming a barrel and a piston of a syringe comprises a cylindrical glass body having at one end an open neck and a peripheral external flange around an outer end of the neck, and a peripheral rounded bead at an open opposite end, and a piston having a cylindrical head within and concentric with the cylindrical glass body in slidable hermetically sealing relationship with the inner surface of the body, the piston being located to define a chamber of volume equal to the nominal capacity of the vial between the piston head and the neck of the vial, the piston having an integral axial flexible extension of lesser diameter than the head and extending towards but ending just short of said open opposite end of the body, the flexible extension being configured for releasable coupling with a socket at an end of a plunger, and the vial having at least sufficient stability, when standing on the peripheral bead, to pass reliably through conventional vial filling and capping machinery without tipping over, wherein the bead is formed so that the bead is at least partially inwardly of an interior surface of a side wall of the glass body, an external extent of the bead beyond the remainder of an external surface of the wall of the body being sufficiently slight to leave said external wall free of projections having an adverse effect on the stability of the vial.

The differences between such vials and a conventional vial do not prevent them from being filled and capped in conventional vial filling and capping machinery; indeed, apart from the replacement of the bottom wall of the vial by a piston as specified, it is a conventional vial, and can be handled normally by the machinery during filling with either liquid or solid material. The presence of the piston which is relatively massive, in the lower part of the vial even helps stabilize the latter during filling. Furthermore, liquid filled vials may be lyophilized utilizing special stoppers either as known in the art or as described below. Obviously the cubic capacity of such a vial is less than the capacity of a conventional vial of comparable overall dimensions but for most purposes this is immaterial.

The invention also extends to a method of packaging a pharmaceutical in a pharmaceutical vial formed of rigid transparent material with a cylindrical body and a comparatively wide neck at the top of the body, empty of pharmaceutical, in an upright position through conventional vial filling and capping machinery which fills the pharmaceutical into the body through the neck, applies an elastomeric closure to the neck, and applies a cap overlaying the closure to secure the closure to the neck to produce filled and capped vials, characterized in that to permit subsequent administration via injection direct from the vial, a cylindrical side wall of each uncapped empty vial is formed so as to define a bottom opening in place of an integral bottom wall of the vial, with a bead adjacent the bottom opening, any external projection of the bead relative to the outer wall of the vial being too small to cause substantial instability of the vial when conveyed upright adjacent other similar vials during filling and capping, a cylindrical substantially solid piston of resilient material is slidably lodged prior to filling of the vial wholly within the cylindrical side wall above said bottom opening so as to form a hermetic seal with the side wall, an internal and axial extension from the piston, of lesser diameter than the piston and adapted for subsequent coupling to a syringe plunger, is oriented so as to extend downwardly towards the bottom opening.

A vial in accordance with the invention may be converted into a syringe by the addition of a plunger cou-

pled to the piston and an outer cap which acts as a needle carrier. More specifically, the syringe includes as well as the vial a syringe plunger connected to the flexible extension from the piston, and an outer cap engaged over the cap of the vial, the outer cap having a hollow needle projecting axially within the cap and a coupling for engagement with injection means and communicating with said hollow needle, the outer cap being axially movable relative to said cap of the vial from a position in which the needle ends short of the cap of the vial to a position in which it penetrates the cap of the vial. The plunger is provided with radially extending flanges for sustaining actuating forces applied to the syringe through a flange grip provided on the outer cap or on a plunger guide or piston stabilizer ring applied to the open end of the vial.

In a syringe for a two component medicament, it is necessary to provide for packaging of the second component and its admixture with the first component in the vial prior to dispensing. The invention thus further extends to a capsule assembly comprising a generally cylindrical sealed capsule having walls formed of a flexible needle penetrable material of suitable properties, a generally cylindrical neck defined by said walls at one end of the capsule, said neck having axially spaced inner and outer peripheral ridges, and a generally cylindrical cap applied to said neck so that a detent within the cap engages the outer peripheral ridge on the neck, a hollow cannula being formed integral with and passing through said cap so that an inner penetrating end within the cap ends short of the neck of the capsule and an outer end formed either in the form of a needle or a fluid coupling which extends outwardly of the cap, the cap being displaceable relative to the capsule to a position in which the detent rides over the inner ridge and the inner end of the needle penetrates the neck of the capsule, the cap and capsule being of a diameter such that they can enter the tubular plunger to a position in which the outer end of the cannula, if of needle form penetrates the septum of the piston when the plunger is engaged with the latter. An alternative arrangement may be used where the outer end of the cannula is a coupling, in which case the latter is connected to the coupling on the outer cap of the syringe, with the plunger being used as a support for the capsule prior to being coupled to the piston.

Thus the injection system comprises a sequence of components of which various sub-sequences can be combined to form injection systems for preparations requiring shipping and storage as two separate components, certain sub-sequences themselves having utility respectively as injection systems for single component liquid preparations. "Injection" is utilized broadly to cover hypodermic, intramuscular and intravenous injection, gravity and mechanical infusion, and injection into other vessels utilized in medical treatment or testing. For the purposes of description, the "front" or "top" end of an injection system will be considered the end of the system from which a liquid preparation is so injected.

The arrangement including the capsule assembly has a number of advantages in the manufacture and use of prefilled syringes for two component systems; furthermore, without the third cap and the sealed capsule containing the second component the remaining components provide, according to a further feature of the invention, advantages in the manufacture and use of prefilled syringes for single component systems. The third cap and sealed capsule provide, according to yet a further feature of the invention, an advantageous subsystem for various applications in which a sealed sterile source of a liquid is required for injection, or dropwise introduction into other containers used in medical procedures. With prefilled syringes for two components systems, either the capsule or the capsule and the third cap, may be sold, or shipped separately. This enables different diluents or sizes of capsule to be selected, or a common set of diluent capsules to be utilized with syringe assemblies containing different first components, thus simplifying inventory control.

As an alternative to the use of capsules, shell vials may be utilized in an advantageous manner.

Further features of the invention will become apparent from the following description of a preferred embodiment thereof with reference to the accompanying drawings.

SHORT DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective exploded view of the mechanical components of a syringe system including a vial in accordance with the invention;

FIG. 2 is a partially longitudinally sectioned, partially exploded view of the syringe components showing some further details of their construction;

FIGS. 3, 4 and 5 illustrate preparation of the syringe system to provide a syringe ready for use;

FIGS. 6, 7 and 8 illustrate exemplary applications of the syringe;

FIGS. 9 and 10 illustrate an optional feature of a vial in accordance with the invention;

FIGS. 11 and 12 are elevational and exploded views of an alternative embodiment of the syringe system;

FIG. 13 shows the separated parts a further embodiment of the syringe system;

FIG. 14 shows, separated, a diluent capsule and cap for use with the system of FIG. 13;

FIG. 15 is a longitudinal cross section through the assembled system of FIGS. 13 and 14;

FIG. 16 is a fragmentary view of a syringe in accordance with the invention utilized in conjunction with an I.V. bag;

FIG. 17 is an exploded isometric view of the components of a first embodiment of the syringe;

FIG. 18 is a vertical section through a vial portion of the syringe, ready for filling;

FIG. 19 is a longitudinal section through an assembled syringe, after discharge of its contents;

FIG. 20 is a fragmentary longitudinal section on an enlarged scale of a portion of the syringe shown in FIG. 3, showing a modification of the arrangement shown in that Figure; and

FIG. 21 is an enlarged vertical section through the head of a second embodiment of the syringe, also showing adjacent parts of a modified piston retainer and finger grip.

FIGS. 22A through I illustrate one mode of utilizing a shell vial in conjunction with a vial in accordance with the invention to provide a syringe system; and

FIGS. 23A through G illustrate a second mode of utilizing a shell vial in conjunction with a vial in accordance with the invention to provide a syringe system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a syringe system for the injection of a liquid preparation stored as two compo-

nents comprises seven primary mechanical components, apart from the components of the preparation, which latter are shown in FIG. 2 but not FIG. 1. The components of the preparation typically comprise a first component A which may be in any physical state suitable for storage in vial, and a second liquid component B, typically but not necessarily sterile water. The liquid component B is stored in a sealed capsule 14 of flexible material, manufactured using conventional techniques from a material, usually synthetic plastic, which is compatible with the contents of the capsule. The first component is stored in a cylindrical vial 6, typically of glass, and capped by an annular cap 4 which retains a conventional needle penetrable sealing member accessible through a central opening in the cap. By a vial is meant a cylindrical vessel which can assume a stable upright position supported by its base, the overall height of the vessel exceeding the external diameter of the rim of its base by a factor sufficiently small that it remains stable when passing through conventional vial filling and capping equipment utilized to fill and cap the vial. This factor preferably does not exceed 2.5 for the present embodiment, but can be increased by means discussed further with reference to FIGS. 17-21. A neck at the upper end of the vial 6, which is capped by the cap 4, has a relatively internal diameter characteristic of such vessels, usually not less than about 7.5 mm for liquid or 10 mm for solids, so that filling with either liquids or solids can be readily achieved. The cap 4 is formed by an aluminum sleeve, having a flange retaining a sealing member formed by a soft rubber disc or plug 5 over or in the front end opening, and tightly crimped onto a neck at the front end of the vial so as to seal the latter. A major difference from conventional vials is that the conventional bottom wall of the vial is replaced by an axially movable piston 8 wholly within the vial and in sealing contact with the vial walls. When received within the vial 6, this piston in no way interferes with the handling of the vial using conventional machinery, and in particular permits the vial to be stood on its base with its neck (which forms the front end of the vial when in use) upwards as it passes through the filling and capping equipment.

The filled vial 6 may be converted into a prefilled syringe by applying an outer cap 2 over the cap 4 and positively attaching a cylindrical plunger sleeve 10 to the piston 8. The piston 8, typically formed of rubber, is moulded with a rearward extension 16 with an external thread 18, whilst the interior of the front end of the plunger sleeve 10 is formed with a complementary internal thread 20 so that it may be screwed onto the piston 8. The outer cap 2 fits over the inner cap 4 so that a hollow needle 22 formed within the cap 2 does not reach the penetrable zone of the cap 4. On the front of the cap 2 and in communication with the hollow needle 2 is a coupling adapter 27, for example similar to those sold under the trade mark LUER-LOK, for connection of the syringe to a needle 28 or other instrumentality (see FIGS. 6-8). To prepare the syringe for use, the outer cap 2 is pulled back over the inner cap 4 so that the needle 22 penetrates the cap, and the needle 28 or other instrumentality is applied. This should be done without pressing on the plunger sleeve so as to avoid accidental ejection of the contents of the syringe. The rear ends of both cap 2 and the sleeve 10 are formed with radially extending flanges 24 and 26 respectively which form finger grips for operation of the syringe. Thus if a user grips the syringe by the flanges as shown in FIG. 6 and presses them towards each other, the contents of the syringe can be expelled through the needle 22 and the needle 28. It will be noted that the rear end of the vial 6 is formed with only a relatively slight external bead 7 rather than the wide finger flange commonly found on the barrels of conventional syringes. In the present arrangement, the flange 24 provides the function of such a finger flange, enabling the bead 7 to be reduced to a size which will avoid such interference between the flanges of adjacent vials as would cause tipping when the vials are conveyed in a vertical attitude through filling and capping equipment.

In many applications, it is desirable to prevent premature penetration of the plug 5 by the needle 22, and therefore the cap 2 may be moulded with short internal threads (not shown) which prevent rearward movement of the cap 2 unless it is twisted so that the threads bite into the soft aluminum of the cap 4 and draw the cap 2 rearwardly so that the needle 22 can penetrate the plug.

A prefilled syringe constructed as discussed above has significant advantages over conventional prefilled syringes in that the vial may be filled using conventional vial filling equipment, and yet may be utilized directly instead of requiring its contents to be transferred to a syringe prior to use as has been conventional in the use of vials.

The vial may also be charged with material which is not directly injectable, such as solids which must be dissolved or suspended in a liquid medium prior to injection. In this case the liquid medium is sealed as already described in a flexible capsule 14. A third cap 12 is either applied to the capsule as shown in FIG. 2, or inserted into the plunger sleeve 10 so that a screw thread 30 on the exterior of the cap engages the screw thread 20 within the sleeve.

A neck 34 of the capsule 14 has two peripheral ridges 36 and 38. If the cap 12 is applied to the capsule, a detent 40 within the cap is pushed over only the outer ridge 38 so that a rear end portion 42 of a hollow needle mounted in the cap stops short of the end of the capsule. By forcing the detent 40 rearwardly over the ridge 36, the needle portion 42 can be forced rearwardly so as to penetrate the capsule. A forward end portion 44 of the hollow needle has a length such that when the cap 12 is screwed into the sleeve 10, and the sleeve 10 is screwed onto the piston 8, the needle portion 44 penetrates a resilient septum 50 normally separating axial passages 46 and 48 formed in the front and rear of the piston.

In use, if the capsule 14 and cap 12 are shipped as a separate unit, this unit is screwed into the sleeve 10 (see FIG. 3), and the sleeve 10 is pushed into the rear of the vial 6 so that the needle portion 44 penetrates the septum 50 of the piston 8 and the thread 20 is screwed onto the thread 18 of the piston (see FIG. 4). This action also substantially unscrews the cap 12 from the thread 20. The capsule 14 is then pressed forward onto the needle portion 42, and the liquid contents of the capsule can then be squeezed through the needle and into admixture with the first component in front of the piston 8. Thereafter the capsule 14 and cap 12 may be pulled as a unit from the sleeve 10 and discarded (see FIG. 5). The septum 50 reseals as the needle portion 44 is withdrawn, leaving a syringe ready for use as illustrated in FIGS. 6-8. Alternatively, if the cap 12 is prefitted to the sleeve, the sleeve 10 may be screwed onto the piston 8, and the capsule 14 pressed into the sleeve 10 and the cap 12 so as to establish communication between the capsule

and the space forward of the piston, the procedure thereafter being the same.

Rather than being used conventionally with a needle as shown in FIG. 6, the prepared syringe may be used for gravitational or mechanical infusion as shown in FIGS. 7 and 8. In FIG. 7, the adapter 27 is fitted to a complementary coupling on a gravity infuser 52 to provide a drip feed, the sleeve 18 having been unscrewed and discarded, together with the cap 12 and capsule 14, if used. In FIG. 8, the syringe is mounted in a mechanical infuser 54 such as that sold under the trade mark BARD, the latter being equipped with clamps 56, 58, 60 suited for engagement with the syringe.

By basing the system on an open-bottomed vial 6 closed at its bottom end by a piston 8 equipped with means such as the screw thread 18 for coupling it to a plunger of sleeve form, and with a needle penetrable septum 50, in optional conjunction with sealed flexible capsules of diluent, great flexibility in application can be obtained, using components which are easy to fill, compact to ship, and easy to make ready for use.

Referring now to FIGS. 9 and 10, the rubber disk or plug retained by the cap 4 on the vial 6 may be replaced by a modified plug 60 as shown in perspective from beneath and one side in FIG. 9, and partially installed on a vial 6 in FIG. 9. Use of such a plug 60 is advantageous when the solid component of a medicament is to be prepared in situ in the vial by lyophilization. The vial is filled with a liquid preparation to be lyophilized, and plug 60 inserted to the position shown in FIG. 9, so that the interior of the vial communicates with its environment through a central passageway 61 and radial bores 62, the passageway and the bores being no larger than needed for the removal of water vapour during lyophilization. The plug is split at 63 to facilitate moulding. After filling the contents of the vial are rapidly frozen and vacuum dried to leave a solid residue in the vial which can be reconstituted immediately before use. The plug 60 is then moved to the full extent permitted by a flange 64 into the neck of the vial 6 and secured by a cap 4. Whilst a conventional lyophilization stopper could be utilized in place of the plug 60, the latter has the advantage of minimizing the amount of liquid trapped within the stopper during use of the syringe. For the same reason, the head of the piston 8 is shaped so as to minimize dead space in the neck of the vial when the contents of the vial are expelled during use of the syringe.

FIGS. 11 and 12 illustrate an alternate configuration of the syringe. The various components are essentially identical to those already described, and the same reference numerals are utilized except that the outer needle 44 of the conduit extending through the cap 12 is replaced by an extension 70 which is configured at its outer end to couple with a standard syringe coupling such as the coupling 27 on the cap 2. This enables the capsule 14, once inserted in the plunger 10, to be locked through the extension 70 and the coupling 27 to the cap 2 to produce the compact assembly shown in FIG. 11. The inner end of the plunger 10 is a press fit on an annular retaining flange 33 formed on the cap 2. To prepare the syringe for use, the cap 2 is forced rearwardly over the cap 4 so that the needle 22 (see FIG. 2) pierces the seal 5, and the capsule 14 is forced forward so that it is pierced by the needle 42 and its contents can be expelled through the needle 42, the extension 70, the coupling 27 and the needle 22 into the vial 6. The assembly of the capsule 14 and the plunger 10 can then be released from the remainder of the syringe by turning so as to release the extension 70 from the coupling 27, a needle (not shown) may be applied to the coupling 27, the capsule 14 is removed from the plunger 11 and discarded, and the plunger 11 is screwed onto the coupling 18 to ready the syringe for use. With this arrangement, the passage 46 in the piston 8 is not required, although the passage 48 may be retained to save material and enhance the flexibility of the extension 18 of the piston.

A similar arrangement may be utilized for single component medicaments in which case the capsule 14 and cap 12 are not provided. The arrangement is advantageous for both single and multiple component medicaments since only the vial need be assembled and filled in a clean room, the only additional step required over the filling of a conventional vial being the insertion of the piston 8. The plunger 10 may be pressed onto the cap 2, and this assembly, if desired together with a needle and/or a capsule 12 and cap 14, may be separately sterilized and packaged, without endangering the stability or destroying the contents of the vial, which will often be sensitive to heat or radiation utilized for sterilization purposes. Since the capsule 12 can withstand conventional terminal sterilization techniques (see further below), it can be sterilized independently of the vial. This is a major advantage over many two-component syringe systems in which the components are separated only by some form of penetrable plug or diaphragm and must therefore either be fully assembled in a clean room, or subjected in assembled form to terminal sterilization techniques which may destroy or damage a component of the pharmaceutical preparation.

Where the capsule 12 is not being used, it is possible to utilize a cap 2 in which the needle 22 is not provided, and instead use a needle arrangement as shown in FIG. 13 or FIG. 15.

Features of presently most preferred embodiments of the invention are shown in FIGS. 13-15. The same reference numerals are used to denote the same parts in these figures as in the previous embodiments, where applicable, and construction and operation are similar except where otherwise indicated.

FIGS. 13-15 show a further vial and syringe system according to the invention, the vial comprising a body 6 of rigid transparent material, usually glass although synthetic plastic resins might be utilized in certain applications. The body has the general configuration of a conventional vial except for the absence of a bottom wall. In order to compensate for the strengthening effect which would be provided by the bottom wall, in order to provide a detent for an optional plunger stabilizer ring 15 described further below, and in order to permit a slight flare at the extreme bottom end of the vial, a rounded bead 7 is provided around the perimeter of the bottom end of the body, although its peripheral extent should not be sufficient to increase substantially the diameter of the vial or decrease substantially its stability during handling.

A medicament A is retained within the vial by a piston 8. A closure 69 substantially fills a neck portion 67 of the vial after the vial, closed at the bottom by the piston, has been filled through its neck portion by a conventional vial filling machine. Although the medicament shown is a solid, it may be a liquid, or filled as a liquid and lyophilized to leave a solid residue. The piston 8 is moulded from rubber, preferably of at least 50 durometer hardness, and is formed with multiple, preferable three, peripheral ribs 81 on its outer surface, the

external diameter of the ribs being slightly greater than the internal diameter of the body 6 so that an hermetic seal is established when the piston is pressed into the bottom of the body, initial entry being assisted by the flare mentioned above. The piston is moulded as a substantially solid body so that it has sufficient rigidity to maintain the desired hermetic seal with the body, any central bores within the piston (see FIG. 15) required to assist needle penetration being of insufficient radial extent to have any significant effect on its rigidity. Although in the piston shown in FIG. 16, a central bore 48 does just extend into the piston proper, its axial extent within the piston and its diameter are sufficiently small relative to the piston diameter that the rigidity of the piston is not substantially reduced. The longer bore 46 through the piston shown in FIG. 15 is of even smaller diameter so as not to prejudice piston rigidity.

The piston has a downward extension 18 of reduced diameter, in which the bore 48 is also present. The diameter of the bore 48 forms in this case a greater portion of the diameter of the extension 18, whose flexibility is thus somewhat increased by its presence. The extension carries on its outer surface a multistart thread, defined by grooves 16 which terminate abruptly short of the piston, forming abutments serving a purpose discussed further below. Provided that the hardness and rigidity requirements for the piston as a whole are met, the rubber utilized to form the piston, and any external coating on the rubber (which may act to increase the effective hardness of the rubber), are selected for compatibility with the medicament contained in the syringe, a number of approved materials being available and well known in the pharmaceutical art.

The neck closure 60 may be formed of similar rubber, and is similar in construction to that shown in FIGS. 9 and 10 if lyophilization of the syringe contents is required: otherwise the slot 63 and bores 62 (see FIG. 9) may be omitted. After insertion of the closure 60, its flange 64 may be held in place by a conventional cap 4 crimped over the flange and a flange on the neck of the bottle. Such a cap 4 may have a flip-off top attached to a separable central portion of the cap, partially severed from the remainder of the cap so that these portions may be broken away prior to assembly of the syringe to expose a central needle penetrable zone of the closure 60 above the bore 61.

The piston together with its extension 18 is relatively massive, with a weight which typically amounts to at least a major portion of that of the body 6. This weight in the lower part of the body assists in stabilising the vial during handling and filling and further inhibits tipping.

As mentioned above, vial assembly and filling will normally be performed in a clean room, since many pharmaceuticals will not withstand terminal sterilization procedures. The only additional step which requires to be carried out in the clean room other than is conventional in the filling of vials is the insertion of the piston 8.

In order to convert the basic vial into a syringe system, either one of two different approaches can be used, similar respectively to those described with reference to FIGS. 1 to 6 and FIGS. 11 and 12 above. Only the differences from that corresponding to FIGS. 1 to 6 will be described in detail for the present embodiment, since the differences from the system of FIGS. 11 and 12 arrangement will in general be similar. FIGS. 13 and 14 show the components of a syringe system separated, whilst FIG. 15 shown them assembled and sectioned (although an alternative needle arrangement is shown in FIG. 15). It should be understood that the diluent cartridge 14 and cartridge cap 12 are optional features of the system and will only be utilized when a diluent or solvent is required for the content of the vial which is not provided by some other means. When building a system similar to that shown in FIGS. 11 and 12, the same parts will be used, except that if the cartridge 14 and the cap 12 are used, the cap 12 will be modified in the manner illustrated in FIGS. 11 and 12. Assembly in the manner described with reference to FIGS. 11 and 12 has the advantages already described.

Referring to FIGS. 13 and 15, an outer cap 2 is pushed over the cap 4, and is similar to that shown in FIGS. 1, 2 and 12, except that the internal needle 22 shown in FIGS. 1 and 2 is omitted, the syringe being utilized with an alternative needle arrangement. In FIG. 13, a conventional double ended needle 28, is shown, the inner end of which replaces the needle 22.

FIG. 15 shows an arrangement in which the needle 28 may be single ended, an auxiliary hollow needle 35 being provided with a cylindrical sleeve 37 at the top which replaces the outer extremity of the inner portion of the coupling 27. A cap 39 is provided to retain the needle 35 within the coupling 27 until the needle 28 is fitted. When the syringe is to be used, the cap 39 is removed, and the sleeve of the needle is placed over the sleeve 37 and pushed down so that the needle 35 can penetrate the top of the vial and the needle 28 can be engaged with the coupling 27.

These needle arrangements are preferred for a syringe which is shipped in an essentially ready-to-use form, since the cap 2 may be pushed fully onto the cap 4 during assembly, yet the closure 60 remains unpenetrated until the needle (or other instrumentality as discussed below) is fitted at the time of use. On the other hand, the integral needle 22 is convenient where the assembly is to be utilized in the manner shown in FIGS. 11 and 12 and a capsule 12 is utilized. The inner surface of the cap 2 is provided with longitudinal ribs 23 which indent the soft aluminum of which the cap 4 is typically fabricated, and help retain the cap 2. The portions 41 and 43 of the cap 4, if present, are of course broken away prior to application of the cap 2.

The cap 4, closure 60, vial body 6 and piston 8 have already been described in detail above. The plunger 10 differs from that shown in FIGS. 1 and 2 in two respects. Its internal threads 20 end abruptly at abutments short of the front end of the plunger, so that when the plunger is screwed onto the extension of the piston, the abutments at the ends of the threads meet abutments at the ends of the external grooves on the extension which grooves in this embodiment stop short of the inner end of the extension, just before the inner end of the plunger contacts the rear surface of the piston. This prevents the plunger being screwed excessively tightly against the back of the piston in a manner which might result in rocking movements of the plunger being transmitted directly to the piston. Instead such movements are largely absorbed by the flexibility of the extension 18. Secondly, the flange 26 at the rear end of the plunger is moulded so that about one half of its periphery is separated into an integral loop 11, which can be flexed rearwardly about hinge lines 13, and serves either as a thumb loop to assist manipulation of the syringe, or a suspension loop from which the syringe can be hung during infusion of its contents as discussed further below. The synthetic plastic material from which the

plunger is moulded is selected from those having hinge forming capability such as many pharmaceutically acceptable grades of polypropylene.

In order to provide further stabilization of the plunger, to prevent its withdrawal from the body, and to provide a finger grip during manipulation of the syringe, particularly where longer vial bodies 6 are utilized, an optional plunger stabilizer and adapter ring 15 may be provided. This has axially extending inner flanges 150 which enter the inner end of the body, and retaining lugs 152, which snap over the bead 7. Openings 154 and flanges 156 may be provided on the rear surface of the ring, as required, to assist in adapting the syringe to infuser apparatus such as that shown in FIG. 8.

Where the contents of the vial are liquid and do not require reconstitution or dilution, or reconstitution is effected by a diluent or solvent introduced via a needle or cannula through the closure 60, the cartridge cap 12 and diluent cartridge 14 are not required, the components already described constituting a complete syringe system. Otherwise these components may be provided and utilized as already described in relation to the embodiments of FIGS. 1 to 6 or FIGS. 11 and 12. The components themselves are however somewhat modified as shown in FIG. 14, to facilitate handling. A skirt portion 120 of the cap is formed with longitudinal slots 122 extending from its rear edge, and inner lips 124 around the inner periphery of that edge, whilst a front extension of the cartridge 14 is provided with ribs 142 extending longitudinally between the peripheral ridges 36 and 38, which ribs are accommodated by the slots 122. The ribs 142 are continued beyond a peripheral groove behind the ridge 36. The threads 30 and the cap 12 are reduced to short ridges between certain of the slots 122. Because of the slots, the cap 12 is readily engaged over the ridge 38, but when the assembly is inserted into the interior of the plunger 10, the diameter of the cap relative to the internal chamber of the plunger 13 such that the lip 124 is pressed into the ring of shallow recesses defined between the ridges 36 and 38 and the ribs 142, thus ensuring that the threads 30 may be engaged with the threads 20 within the plunger by turning the capsule, and inhibiting accidental forward movement of the cartridge 14 into the cap 12. Further turning of the capsule drives the needle 44 forward into the bore 48 (see FIG. 14) and thence through a septum in the bore into a small diameter counterbore 46 through the head of the piston (similar to that shown in FIG. 2), a piston modified in this manner being utilized when a diluent cartridge is to be used. The cartridge can then be forced forward so that the lips 124 ride over the ridge 38, permitting the needle 42 to penetrate the capsule whose contents can then be transferred to the vial by squeezing and/or aspiration.

Provided that the cap 12 is provided with a coupling 70, the capsule can of course also be utilized as described with reference to FIGS. 11 and 12, in which case the passage 46 in the piston is not required.

The capsule 14 is blow moulded from a heat sealable, film grade, low melting, high ethylene random propylene-ethylene copolymer suitable for medical use. An example of such a material, already approved for pharmaceutical applications, is DYPRO (trade mark) polypropylene Z9350 from Fina Oil and Chemical Company which has a melting point of about 130° C. Such a material, formed by injection of ethylene into a propylene matrix, combines necessary qualities of transparency, impermeability and flexibility with the stability to withstand sterilizing temperatures in an autoclave, despite its low melting point; the pressure in the autoclave is maintained at a sufficient level to prevent bursting of the capsule during sterilization. Conventional capsule materials are unsuitable for use in this application, since they lack at least one of the necessary properties of flexibility, transparency, impermeability, penetrability, compatibility with conventional pharmaceutical diluents, and ability to withstand sterilization temperatures without failure or degradation.

Utilization of syringes incorporating the above described modifications is similar to that of the other embodiments already described. The contents of the syringe may be delivered as already described with reference to FIGS. 6, 7 or 8, or in other ways. With a small modification to certain of the syringe components, the syringe contents may be reconstituted or diluted with fluid from an I.V. bag or minibag 160 and then injected into the bag for delivery, as shown in FIG. 16. Both the inner and outer components of coupling adaptor 27 of the cap 2 are elongated, and the bores of the inner component of the coupling adaptor and of the needle 22 are sufficient to provide an air venting passage around the read end of the needle 22 when fitted to the adaptor 27. A locking sleeve 29 on the needle 22, which sleeve engages the adaptor 27, is provided with a ventilation opening 31, such that when the sleeve 29 is screwed partially onto the adaptor as shown, air can escape through the sleeve as fluid from the bag 160 enters the syringe through the needle 22. When a desired amount of fluid has entered the syringe, the ventilation opening is closed by screwing the needle further onto the adaptor, following which the contents of the syringe may be injected into the bag 160.

Referring to FIGS. 17–20 of the drawings, a syringe comprises a syringe barrel in the form of a somewhat elongated glass vial 202, of which the bottom wall is absent apart from a slight inward projection of a strengthening bead 206 formed at the bottom of a side wall 204 of the vial and best seen in FIG. 20. In the example shown the strengthening bead 206 also has a very slight outward projection, but this is far smaller than would be necessary if the bead were formed wholly externally of the side wall 204, and may be entirely eliminated. In any event, the outward extent of the projection should be insufficient to prevent vials from standing very closely adjacent to one another without sufficient space to tip. Typically the projection will not exceed about one fifth of the total thickness of the bead. The projection of the bead on the inside should also be limited, both so that the head 210 of a moulded rubber piston 208 can be inserted into the vial past the projection (this is facilitated by the presence of peripheral grooves 212 in the head between sealing lands 214), and so that a sleeve 218 of a combined finger grip, piston stop and plunger guide 216 (henceforth referred to as the finger grip) can be pushed past the projection whilst remaining a snug fit within the side wall of the vial. Insertion is facilitated by the slight flare provided at the bottom entry to the vial body by the rounding of the bead, and the insertion is readily mechanized.

The piston 208 is also provided with an integrally moulded downward extension 220 which is formed with a central cavity 223 to increase its flexibility relative to the head 210 of the piston which is substantially solid. The piston is dimensioned so that when it is in-

serted in the vial 202, the lands 214 are compressed sufficiently to form a hermetic seal against the interior of wall 204 whilst permitting the piston to be moved longitudinally of the vial. Initially, the piston is located at the bottom of the vial (see FIG. 18), with the bottom of extension 228 just within the vial so that it does not affect the ability of the vial to stand upright on its base formed by the bead 206. The location of the fairly massive solid rubber piston 208 at the base of the vial helps stabilize the empty vial 202, even when the height of the latter is somewhat greater relative to its diameter than is normally required for stability. The practical limit of the height to diameter ratio is set entirely by the requirement that the vials can be conveyed through a conventional vial filling and capping machine in a sufficient stable manner to permit reliable operation of the machine. In the example shown, the vial has an outside diameter of approximately 3 cm and a height of 12.8 cm for this diameter. A height of 14 centimeters is believed to approach the practical limit for stability, but this ratio will vary somewhat according to the relative wall thickness of the vial and the weight of the piston. Provided that the outward projection of the bead 206 is insufficient to affect stability, so that the vials can jostle without applying tipping force to each other, and assuming use of a piston generally as described, the maximum ratio attainible should be greater than 4, but will be less than 5.

The stopper 222 and cap 224 applied by the conventional vial filling and capping machinery may be of conventional construction, although the stopper 222 is preferably designed substantially to fill the neck of the vial so as to minimize dead space above the piston when the latter is pushed to the top of the vial (see FIG. 3). This ensures that as much as possible of the contents of a syringe formed from the vial can be expelled by movement of the piston.

The cap 224 is preferably modified as shown in FIG. 19 and FIG. 20. In FIG. 19, a conventional main cap cooperates with a moulded plastic adaptor assembly comprising an annular flange 226 within the cap, a cylindrical extension 228 extending through the cap and a thin diaphragm 230 closing a bottom end of the extension. An internal thread 232, similar to that provided on conventional syringe adaptors for receiving needles, such as those sold under the trade-mark LUER-LOK, is formed within the adaptor. A removable push on cap may be provided to close the open end of the adaptor during storage, being removed prior to use. In FIG. 20, the cylindrical extension 228 is formed integrally with the aluminum cap, again with an internal thread 232. I have found that the extension 228 can be accommodated by conventional vial capping machinery, at any rate with no more than minor modification, without interfering with the capping process, whilst the provision of such an extension enables the elimination of a separate adaptor cap, and the additional assembly step required to apply it.

In order to convert the vial into a syringe, either a double ended needle 234 of the blood collecting type may be applied directly to the extension 228 (see FIG. 20) or an adaptor 236 (see FIGS. 17 and 19) may be provided for any needle or alternative delivery device equipped with a standard syringe coupling so as to provide the latter with the capability of penetrating the stopper 222, as well as the diaphragm 230 if present. The adaptor 236 has a needle 238 and external thread 240 at one end, the needle providing the penetration function and the thread 240 engaging the thread 232, while its other end provides an internally threaded socket 242 and coaxial spigot 244 for forming a fluid-tight coupling to the needle or the like.

Prior to fitting the double ended needle 234, or needle and adaptor 234, a plunger 246 is applied to the extension 228 of the piston. The plunger has a shaft 248, of cruciform cross-section in the example shown, an internally threaded sleeve 250 at its one end, and an end flange 252 at its other end. The sleeve 250 has internal multistart threads 254, complementary to external multistart threads 256 on the extension 228. The lands between the threads 254 on the sleeve 250 and the threads 256 on the extension 228 both stop short respectively of the outer end of the sleeve 250 and the inner end of the extension 228 so as to form abutments 258, 260 which prevent the sleeve 250 from being screwed tightly against the underside of the head 210 of the piston. This means that any tilting forces applied to the plunger are applied to the relatively flexible extension 228 and not directly to the head 210, thus minimizing the risk of breaking the hermetic seal between the head 210 and the vial.

The plunger is formed of a hinge-forming synthetic plastic such as a pharmaceutical grade polypropylene, and a generally semicircular peripheral portion 262 of the flange end is separated from the remainder of a slot 264, remaining connected only by thin, hinge-forming connections 266. This portion 262 provides a finger loop which can be pulled rearwardly, as shown by broken lines in FIG. 1, to facilitate handling of the plunger. As a supplemental or alternative feature, a notch 272 may be formed in the shaft 248 of the plunger, to provide a hook by means of which the syringe may be suspended when used in certain infusion applications.

In order to provide the various functions of preventing total withdrawal of the piston, forming a guide for the plunger and restricting its tilting movements, and providing a finger grip for the user, the combined finger grip and retainer 216 is pressed into the bottom of the vial 202 after filling and capping of the latter. It comprises the sleeve 218 and a peripheral flange forming oppositely extending finger grips 268. It is also moulded from a pharmaceutical grade of plastic such as polypropylene. The sleeve 218 is a resilient press fit in the open end of the vial 204 so that it is slightly compressed by the internal projection of the bead 206 during insertion. Insertion of the retainer 216 may be facilitated by moderate warming of at least the retainer, and the slight flare provided by the rounding of the bead 206 also facilitates insertion. Beneath the grips 268 the sleeve has shallow arcuate grooves 270 in which the bead 206 snaps as the sleeve is pressed home. Forces applied to the grips 268 tending to pull the sleeve 218 away from the vial in turn tend to deform the sleeve, in such a manner as to increase the grip of the grooves 2700 on the bead thus resisting withdrawal of the sleeve.

During manufacture, the empty vials 204 are conveyed through a conventional sterilizing station, the piston 208 is inserted in each vial 204, and the latter is filled and capped utilizing conventional vial filling and capping machinery (but preferably using a modified cap as shown in FIGS. 17 and 19 or FIG. 20). The guide and finger grip 218 is then pressed into the base of the vial, which is shipped with the plunger 246 unattached. Prior to use, the plunger 246 is screwed onto the piston, and a needle or the like is applied to the extension 228, utiliz-

ing an adaptor 236 if necessary so as to penetrate the stopper 222, at which point the syringe is ready for use.

A modified configuration of the bottom end of the vial body is shown in FIG. 21, in which an alternative approach is utilized to bringing the bead at the bottom end substantially within the diameter of the cylindrical vial body. Peripheral beads around the openings of glass bodies of this type are conventionally formed by flame softening the glass and adjusting the positioning and profile of the bead by rolling the body against suitable forming surfaces. In the FIG. 5 embodiment, a bottom portion 274 of the body 204 is flame softened and rolled so as slightly to reduce its diameter over about a length of typically 5–6 mm, and a fairly conventional outturned rounded bead 206 is formed by flaring the bottom of this reduced diameter section. The reduction in diameter is such that at least the greater part of the bead is within the general diameter of the body. In the example shown, the outside diameter of the bead is very slightly greater than the general outside diameter of the body but this need not be so. In a typical example, the inside and outside diameters of the main portion of the vial body are 27 mm and 30 mm respectively, providing a wall thickness of 1.5 mm, and the reduction in diameter at the bottom is about 1 mm. The bead can then be formed by flaring the bottom end of the vial without increasing the outside diameter of the bead significantly beyond that of the main portion of the vial and typically by no more than 0.5 mm, even though a significant flare 276 can be provided and, because of the flare, the bottom contact line 278 of the vial when free-standing on a plane surface is substantially coincident with the outside diameter of the main body 204 of the vial, thus maximizing stability. Juxtaposition of the vial bodies in the event of jostling on a line will prevent any rumping tendencies which might otherwise occur with a flared bottom configuration of this type.

Whilst the presence of the piston after its insertion in the vial body acts to introduce a substantial mass which tends to stabilize the vial, the mass of the piston relative to that of the vial body will decrease as the height of the latter increases. Nevertheless it will result in a smaller rise of the centre of gravity of the assembly as the vial becomes higher than would otherwise be the case. It is also desirable that the vial bodies be stable without the piston present so that they may be conveyed through a stabilizer prior to insertion of the pistons. The present invention is particularly valuable in this respect since the disturbing influence of a bead at the open end projecting beyond the diameter of the main portion of the body is particularly severe under such conditions.

In order to cooperate with the modified vial body profile, the finger grip/retainer 216 must also be modified. The groove 270 is replaced by a bead 280 at the upper end of the cylindrical portion 218, which bead may be moulded with a taper and if necessary with slots 282 to facilitate insertion, and/or the component 16 may be warmed to facilitate insertion. The bead must retain the component with sufficient tenacity to withstand pressures from the piston which may be developed through pressure build-up in the vial during normal storage, although it should be noted that pressure of the piston on the bead may actually help retain it by forcing it against the shoulder 284. Alternatively or additionally, claws 286 may be moulded onto the component 216 to retain it by external engagement with the bead 206.

Referring now to FIGS. 22 and 23, shell vials are a well known and widely available packaging for pharmaceutical diluents. A shell vial differs from a conventional pharmaceutical or serum vial in that it has no neck. Instead the top of the vial is of the same diameter as the remainder of the cylindrical side wall of the vial, and is closed by a piston quite similar to that utilized by the present applicant to close the bottom of his bottomless vial.

FIG. 22A shows an exploded view of the components of a separately assembled and sterilized unit 300 for use in conjunction with a filled and capped vial 302 similar to that shown at the right of FIG. 12. The unit 300 comprises a shell vial having a cylindrical body 304 closed at one end, and a piston 306 closing its other end to enclose a quantity of pharmaceutical diluent. A moulded plastic tubular adaptor component 308 having a tubular connector 310 at one end similar to the connector element 700 of FIG. 12, and an internal thread 312 within its other end is engaged with an external thread on a extension 314 of the piston 306. The unit further includes a tubular plunger 316 similar to the plunger 10 of FIG. 12, a cap 318 similar to the cap 2 of FIG. 12, a needle 320, and a protective cap 322 which closes the open end of the cap to maintain sterility and provide protection of the needle during storage. This cap is removed immediately before use (see FIG. 22C). The needle 320 is of the double ended type, and is located beneath the cap 318 by a flange 324. A connector 326 on the cap similar to the connector 27 of FIG. 12 engages the connector 310 on the adaptor component 308 in the same way as the connector 27 engages the connector 70 in FIG. 12, so that one end of the needle 320 passes through the adaptor towards the piston extension 314, as seen in FIG. 22B.

After the cap 22 has been removed (FIG. 22C), and also a flip-off protective cover 328 on the cap of the vial 302 (FIG. 22D), the unit 300 is pressed on the vial 302 (FIG. 22E) so that the cap 318 is pressed over the cap 330 of the vial 302 so that the lower end of the needle 328 pierces the closure of the vial 302. At the same time, the flange 324 is pressed upwardly within the cap 318 and causes the upper end of the needle 320 to penetrate a septum within the piston 306.

The shell vial 304 is then pressed downwardly (FIG. 22F) expelling its contents through the needle 320 into the vial 302. If necessary, the piston 332 within the vial 302 is positioned higher in the vial than normal so that it can be displaced downwardly to make room for the contents of vial 304 (see FIG. 22G).

At this point, the assembly 300, with the exception of the cap 318 and the needle 320, is pulled away from the vial 302 by gripping the plunger 316 leaving the cap and needle in place on the vial (FIG. 22G). The plunger 316 is then screwed onto the piston 332 of the vial 302 (FIG. 22H) to form a syringe 334 (FIG. 22I).

In the embodiment just described, the shell vial is dimensioned so as to fit within the tubular plunger. An alternative embodiment is shown in FIGS. 23A–G in which the shell vial 304 is dimensioned so that the tubular plunger 316 has an external diameter less than its internal diameter. The same reference numerals are used to denote components of this embodiment similar to those of FIG. 22A–I, and only the differences will be described. In this instance, the plunger 316 fulfils the functions of the adaptor 308, the screw threads on the pistons 306 and 332 being similar except that the thread 314 on piston 306 may be longer. The plunger 316 is a

press fit on the connector 326 on the cap 318, which in this case is formed with a skirt 336 which fits over the top portion of the vial 302 and also provides a finger grip 338. The entire unit 300 (see FIG. 23C) is assembled into a tubular sleeve 340 (FIG. 23B) which together with the cap 322 maintains sterility of the unit during storage, and also facilitates preparation of the syringe. The vial 304 is a press fit within the upper end of the sleeve 340. After removal of the cap 322, the unit 300 is applied to the vial (FIG. 23D) as in the previous embodiment, and the sleeve 340 is pulled downwardly (FIG. 23E). As before, this forces the cap 318 onto the cap 330 of the vial, causing the needle 320 to pierce both the closure of the vial 302 and the piston 306 of the shell vial 304, and further downward movement of the sleeve 340 forces the contents of the shell vial into the vial 302. At this point the sleeve 340 is rotated to unscrew the piston 306 of the shell vial 304 from the plunger 316 (FIG. 23F) which is then transformed to the piston 332 to complete the syringe.

It should be understood that the sleeve 340 could be omitted, although it is a convenience for packaging and manipulating the syringe, in which case the vial 304 would be manipulated directly rather than through the sleeve 340.

Variations in the above embodiments are possible. For some applications of the syringe, it may be desired to replace the needle 328 by some other instrumentality when the syringe is used, in which case a single ended needle may be located in the assembly 300 so that it will be forced upwardly as the cap 318 is forced onto the vial 302 (the cap in this case will have an internal cannula to pierce the closure of the vial), but will be retained within the shell vial when the latter is removed during preparation of the syringe. If a double ended needle 30 is used, in combination with a cannula, venting of the vial 302 to permit escape of air displaced by the contents of the shell vial 304 becomes possible, in a manner similar to that shown in FIG. 16.

A sleeve similar to the sleeve 340 may also have utility in packaging and manipulating subassemblies for other embodiments of the invention incorporating push-on external caps for the vial similar to the cap 318.

I claim:

1. In a method of packaging a pharmaceutical in a pharmaceutical vial formed of rigid transparent material with a cylindrical body and a comparatively wide open neck at the top of the body, which method comprises conveying uncapped vials, empty of pharmaceutical, in a free-standing upright position through vial filling and capping machinery which fills the pharmaceutical into the body through the open neck, applies an elastomeric closure to the open neck, and applies a cap overlaying the closure to secure the closure to the neck to produce filled and capped vials, the improvement in which, in order to permit subsequent administration via injection direct from the vial, a cylindrical side wall of each uncapped empty vial is formed so as to define a bottom opening at the base of the vial with a bead adjacent to the bottom opening, the outer wall of the vial being free of any external projection of the bead relative thereto sufficient to cause substantial instability of the vial when conveyed upright and free-standing adjacent to other similar vials during filling and capping, and a cylindrical substantially solid piston of resilient material is slidably lodged prior to filling of the vial wholely within the cylindrical side wall above said bottom opening so as to form a hermetic seal with the side wall, so that an internal and axial extension from the piston, of lesser diameter than the piston and adapted for subsequent coupling to a syringe plunger, is oriented so as to extend downwardly within the vial towards the bottom opening.

2. A method according to claim 1, including the further step, following filling and capping, of snap fitting a piston stabilizer ring to the bead so that flanges on the piston stabilizer ring extend into the body between the cylindrical side wall and the piston extension to prevent escape of the piston from the body.

* * * * *

United States Patent [19]

Sams

[11] **Patent Number: 4,865,591**

[45] **Date of Patent: Sep. 12, 1989**

[54] **MEASURED DOSE DISPENSING DEVICE**

[75] Inventor: Bernard Sams, London, England

[73] Assignee: Hypoguard (UK) Limited, Woodbridge, England

[21] Appl. No.: 205,198

[22] Filed: Jun. 10, 1988

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 81,341, Aug. 4, 1987, abandoned.

[30] Foreign Application Priority Data

Jun. 12, 1987 [GB] United Kingdom 8713810

[51] Int. Cl.[4] A61M 5/315

[52] U.S. Cl. 604/186; 604/208; 604/209; 604/211; 222/287; 222/391

[58] Field of Search 604/186, 208, 209, 210, 604/211; 222/43, 309, 325, 326, 327, 391, 287

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Primary Examiner—Martin P. Schwadron
Assistant Examiner—Allen J. Flanigan
Attorney, Agent, or Firm—Willian Brinks Olds Hofer Gilson & Lione

[57] ABSTRACT

The present invention relates to a device for dispensing a fluid from a container by means of the axial movement of a piston within the container under the influence of a plunger moved by the device, which device is adapted to receive the container on its forward end and to move the plunger axially forward towards or within the container so as to dispense a selected amount of fluid from the container upon each actuation of the device, characterized in that the device comprises:

i. a disengageable drive mechanism adapted to be reciprocated axially of the device and adapted to positively engage the plunger whereby the plunger can be moved axially forward by the drive mechanism and to be disengaged from the plunger to permit relative axial movement between the drive mechanism and the plunger;

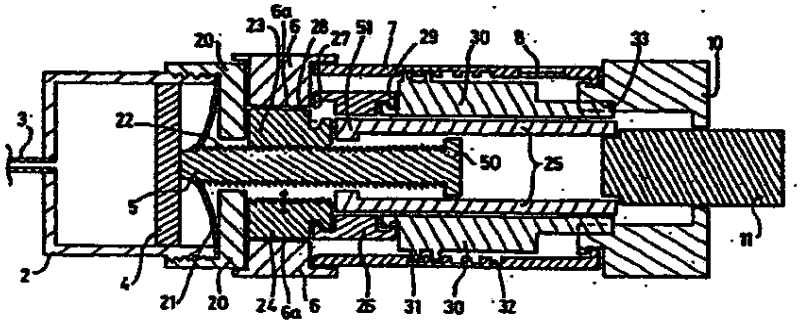
ii. a disengagement means for selectively engaging or disengaging the drive means from the plunger;

iii. an actuating means, which may be integral with or separate from the disengagement means, for actuating the disengagement means, which actuation means requires a positive operation from a user of the device to engage and/or disengage the drive mechanism from the plunger; and

iv. means for selecting the extent of travel of the drive mechanism so as to control the extent of axial movement of the plunger upon actuation of the device.

The invention also provides a device of the invention in association with a container of the fluid to be dispensed.

19 Claims, 4 Drawing Sheets



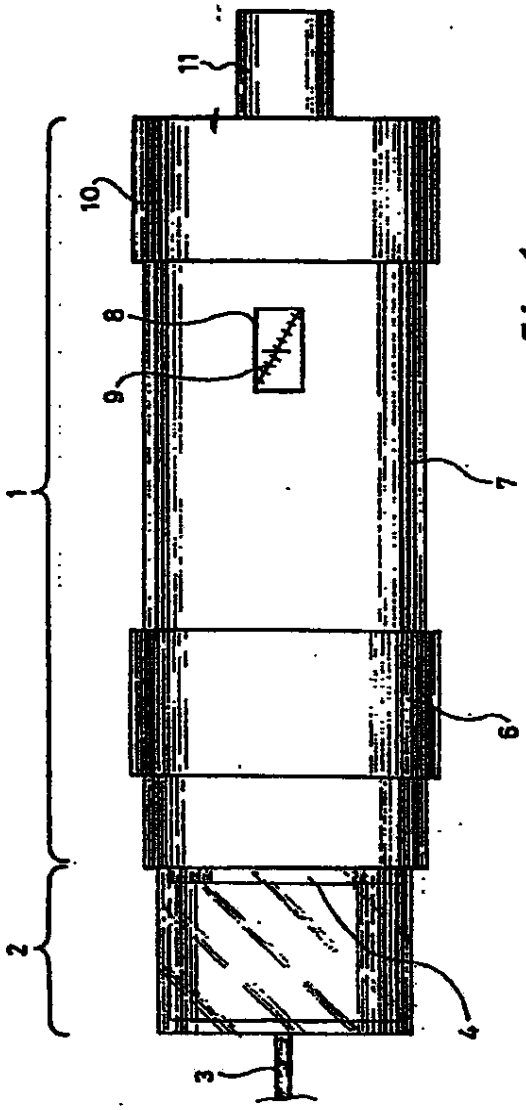


Fig. 1

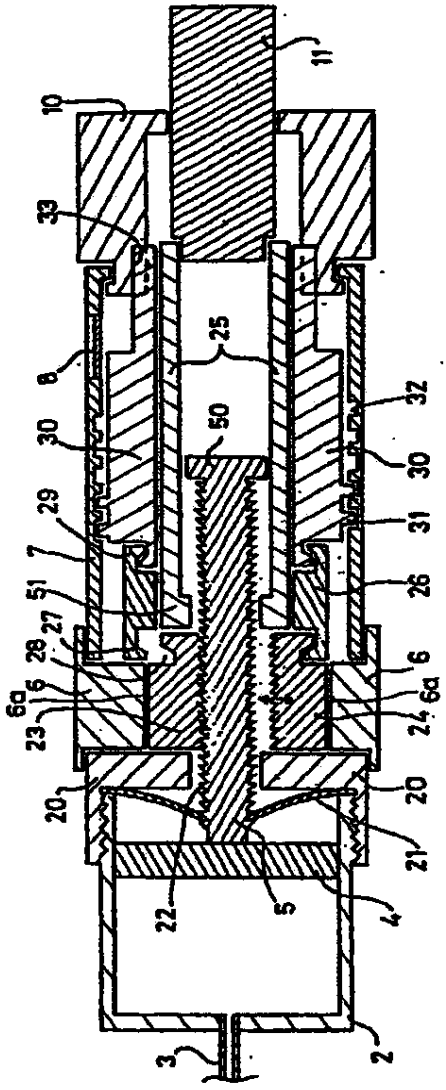

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Fig. 2

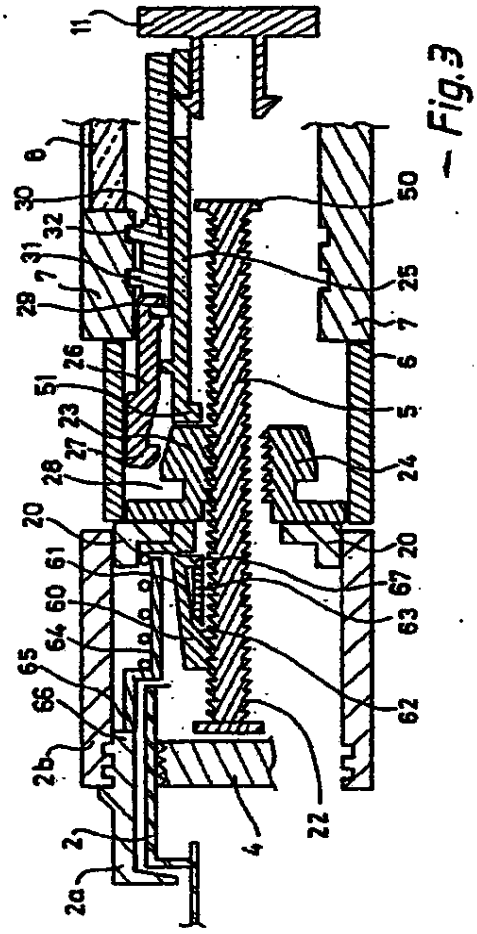
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Fig.3

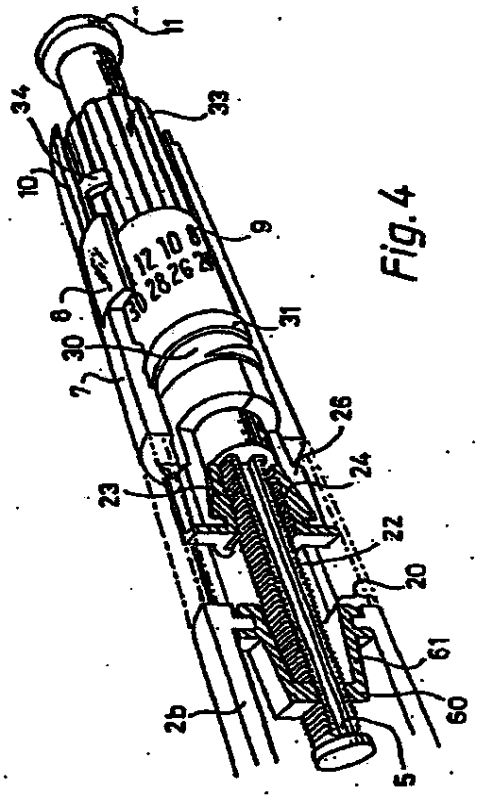

Fig. 4

MEASURED DOSE DISPENSING DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of copending U.S. patent application Ser. No. 07/081,241, filed Aug. 4, 1987 now abandoned. The entire text of this application Ser. No. 07/081,241 is hereby incorporated by reference.

The present invention relates to a measured dose dispensing device.

BACKGROUND TO THE INVENTION

Patients suffering from diabetes often have to inject themselves with frequent doses of insulin and this can be done using a conventional syringe. However, the patients often also suffer from side effects of their illness and are not capable of accurately controlling the operation of such a syringe. It is therefore desirable that they should be provided with means for automatically administering an accurately controlled dosage. However, the dosage required by different patients can vary over quite wide ranges, from for example 2 units of insulin per dose to 30 or more units, and it is necessary to ensure that any device is capable of selecting a range of dosages simply and accurately.

Many forms of dispensing device use a pawl and ratchet mechanism to connect a push button or trigger operated by the user to a plunger driving a piston in the barrel of the syringe or a cartridge carried by the device. This achieves a positive drive on the forward stroke, but allows the button or trigger to be retracted, for example under the bias of a return spring, with the pawl riding over the teeth of the ratchet, in readiness for the next actuation of the device. The drive between the pawl and the ratchet is thus never fully disengaged. Typical of such devices are those described for example in U.S. Pat. Nos. 1997129, 2605763, 2718299, 3517668, 3894663, 3977574, 4022207, 4099549, 4415101, 4457712 and 4470317; French Patent Specifications Nos. 1445659, 1170312 and 1149735; and German Patent Specification No. 730971.

Where any provision is made for selecting the volume of fluid to be dispensed, this is usually by way of stops limiting the depression of the push button or trigger operating the device.

European Patent No. 0037696 describes a device in which positive drive between the plunger and the push button is achieved by having ratchet teeth along the length of the plunger into which engage the co-operating teeth of a spring loaded pawl member carried on an axially operated push member extending through the rear end of the device. A stop engaging in a slot in the push member limits the extent of travel of the push member and the volume of fluid to be dispensed is selected by withdrawing the push member the required distance from the forward extreme of its travel with the pawl riding over the teeth of the ratchet. The dose is administered by depressing the push member which carries the plunger with it. Once the plunger has reached the forward extreme of its travel and the container has been emptied, the pawl automatically disengages from the plunger to allow the plunger to be fully retracted to permit a new container to be fitted to the device.

In the above forms of device, an essential feature of the design is that the pawl is free to ride over the teeth of a ratchet as the pawl is retracted and the drive is thus not fully disconnected from the ratchet so as to be ready for driving the ratchet forward in the next delivery stroke of the device. Firstly, this does not permit a user to correct any error in setting the extent of retraction where this is used to set the amount of fluid to be dispensed. As a result, if too large a retraction has been permitted, the whole of the incorrect dose must be discharged before the device can be correctly set. Secondly, by automatically retracting the pawl in readiness for the next dose, the device is put into a "cocked" condition, which means that a user can operate the device accidentally. Thirdly, we have found that where the user is weak he may not depress the push button or trigger completely or smoothly. This may allow the pawl to retract partially or completely before it has reached the full extent of its forward travel. It will therefore appear to the user that the full dose has not been administered and he will then continue to depress the push button or trigger for its full travel. As a result, the user may administer an overdose, which could be fatal.

GB Specification No. 2109904 A describes a dispensing mechanism in which the plunger has an external screw thread and fits within an internally screw threaded fixed sleeve. The plunger is rotated by a drive cap so as to move the plunger axially. The cap incorporates a pawl and ratchet mechanism so that the cap can be rotated in one direction without rotating the plunger, but rotates the plunger in the opposite direction. The volume of fluid to be dispensed is set by rotating the cap in the first direction the desired amount from a zero point. The dose is dispensed by rotating the cap in the opposite direction back to the zero. Whilst this device is not automatically returned to the "cocked" position after each use, it is cumbersome to use, especially when the user is injecting fluid single handedly into his posterior. Furthermore, since the drive between the cap and the plunger is not fully disengaged, the device can be pumped by repeated rotation and contra-rotation of the cap. It has been proposed in PCT Published Application No. WO 85/02546 to operate a syringe using an electric stepper motor to advance the plunger in the syringe a predetermined amount. This may reduce the risk that an incorrect or excessive dose is dispensed, but such a device is expensive and cumbersome and is not suited for carriage upon the person or for general use.

It has further been proposed, for example in Swiss Patent No. 293302 and U.S. Pat. No. 2695023, to use an automatically engaging latch to limit the travel of the plunger of a syringe to the distance between adjacent notches on the plunger into which the latch engages. This permits the user to dispense only single doses. Where multiple doses are required, the user must repeatedly actuate the latch and must count and remember the number of times he has actuated the latch. This is awkward and often a user cannot remember correctly the number of times he has operated the latch, leading to inaccurate doses.

A further problem with the above devices is that a user cannot determine accurately how much insulin or other medicament is left in the body of the syringe or cartridge and hence whether he can achieve the next dosage completely from that syringe or cartridge or whether he must use a fresh one to achieve the complete dose. Mere visual inspection through the transparent wall of the container is usually too inaccurate to be able

to distinguish between, say, 8 and 14 units of insulin remaining in the container and some more accurate guide is required.

As a result, a need still exists for a simple measured dose dispensing device which can deliver accurately controlled but variable doses of fluid and which can be used single handedly by weak or infirm users without the risk of "pumping" the device to administer an overdose.

SUMMARY OF THE INVENTION

Accordingly, the present invention provides a hand portable device for dispensing a fluid from a container by means of the axial movement of a piston within the container under the influence of a plunger moved by the device, which device is adapted to receive the container at its forward end and to move the plunger axially forward toward or within the container so as to dispense a selected amount of fluid from the container upon each actuation of the device, characterised in that the device comprises:

i. a disengageable drive mechanism adapted to be reciprocated substantially co-axially of the device and adapted to positively engage the plunger whereby the plunger can be moved axially forward by the drive mechanism and adapted to be disengaged from the plunger to permit relative axial movement between the drive mechanism and the plunger;

ii. a disengagement means for selectively engaging and/or disengaging the drive mechanism from the plunger;

iii. an actuation means, which may be integral with or separate from the disengaging means, for actuating the disengagement means, which actuation means requires a positive operation from a user of the device to engage and/or disengage the drive mechanism from the plunger; and

iv. means for selecting the extent of travel of the drive mechanism so as to control the extent of axial movement of the plunger upon actuation of the device.

The device of the invention reduces many of the problems associated with designs proposed hitherto by using a drive mechanism which can be disengaged from the plunger at any point during its travel, notably for the dose selection step. This allows errors in the dose selection to be corrected before the drive is re-engaged. The drive mechanism is locked onto the plunger for the forward stroke of the mechanism, so that the plunger or drive mechanism cannot be partially retracted during the forward stroke, which reduces the risk of administering an overdose. The engagement and/or disengagement of the drive mechanism requires a positive operation to be carried out by the user, so that the device can be left in the de-activated state until the next dose is required and cannot be operated until the positive drive engagement operation has been carried out. However, once the dosage has been selected and the drive has been re-engaged, the device can readily be used single handedly, notably when a dose is being injected into the user's posterior.

The container upon which the device of the invention is to be used can be a conventional syringe body, but is preferably a generally cylindrical cartridge containing the fluid to be dispensed. As indicated above, the invention is of especial use in the self-administration of a medicament, notably insulin, by a user. For convenience, the invention will be described hereinafter in terms of this use.

The medicament is preferably contained in a cartridge, notably one with a comparatively short wide body, typically from 0.3 to 3 cms external diameter and from 3 to 7.5 cms long. The cartridge has one end closed by a transverse membrane or wall, the other being closed by the axially moveable piston. If desired, the one end can carry a hypodermic needle or the like already in position; or this can be provided as a separate component which is secured in place when the cartridge is mounted on the device of the invention. For convenience, the invention will be described hereinafter in terms of the use of a cartridge of insulin.

The cartridge may be mounted at the forward end of the device by any suitable means, for example as a push, screw, bayonet or other fit within an axial socket at the forward end of the device. The socket can contain other components of the device which are to co-operate with the cartridge, for example a mechanism for preventing the plunger from moving rearwardly as described later. It is particularly preferred to provide an internal circumferential annular shoulder or series of projections which act as a stop against which the rim of the cartridge seats when fully home in the socket, thus correctly positioning the cartridge axially in the device.

The cartridge is preferably mounted within a detachable housing which is a screw or other fit into the device, for example into the axial socket. The use of such a housing aids correct mounting of replacement cartridges in the device. By making the housing from a clear plastic material, a user can readily observe the movement of the piston within the cartridge and can assess the amount of fluid in the cartridge. The housing also provides a measure of protection to the cartridge, both physical and against pathogenic organisms and other possible contamination.

Where such a housing is used, the needle end of the cartridge can project through a terminal aperture in the housing or that end of the housing can be closed and can carry a needle or other outlet integrally therewith which projects axially inwardly into the housing to penetrate the membrane at the end of the cartridge.

The cartridge houses the piston which is to be moved by the plunger. This piston can be of conventional design and will usually form part of the cartridge as commercially available. The plunger acts on the piston and the piston can carry a socket or other recess to receive and locate the head of the plunger. In some cases, the plunger can be affixed to the piston and will form part of the cartridge as supplied, in which case the plunger will extend into the device when the cartridge is mounted on the device. However, it is preferred that the plunger form part of the device rather than of the cartridge and, for convenience, the invention will hereinafter be described with respect to this configuration.

The device typically comprises a substantially cylindrical hollow housing containing the various mechanisms of the device as described below assembled substantially co-axially around the plunger.

The plunger is preferably a simple elongated rod which extends axially along the longitudinal axis of the device and can have a substantially circular, polygonal, squared or other cross-section as desired. Thus, the plunger may have two or more opposed flatted faces and/or can have two, or more axial grooves in its surface to assist angular location of the plunger with respect to the other components.

The plunger can have a plain surface onto which the drive mechanism acts by a frictional grasp, as when a

Torrington type mechanism is used. However, it is preferred that the plunger carry an axial series of transverse ribs, grooves or teeth which engage with corresponding teeth carried by the drive mechanism. The teeth can extend for substantially the full length of the plunger, but this need not be the case and the terminal portions of the plunger can have a plain surface. Preferably, the teeth are of a saw tooth form with the scarp or undercut face of the tooth facing rearwardly. It is preferred that the axial distance between adjacent teeth corresponds to the distance the piston is to move in the cartridge to dispense a unit dose, for example 1 or 2 IUs, of insulin.

The drive mechanism for present use is one which can be completely disengaged from the plunger to permit relative axial movement between them and so that there can be no drive between the drive mechanism and the plunger until the drive is positively re-engaged. However, when the drive mechanism is engaged, it locks onto the plunger so that there is substantially no relative movement between them. A suitable drive mechanism may thus incorporate a mechanism which engages and disengages by radial movement, for example a Torrington type drive in which a series of ball or roller bearings are carried in a tapered cup around the plunger. A plug member can be moved axially into the taper to drive the balls further into the taper and thus radially inwardly to clamp onto the plunger.

However, a particularly preferred drive mechanism comprises two or more jaws arranged substantially symmetrically around the plunger and which can be moved radially inwardly to clamp onto the plunger. The radially inward faces of the jaws preferably carry teeth which co-operate with those carried by the plunger to provide a positive locked drive between the drive mechanism and the plunger when the drive is engaged. The teeth on the jaws preferably have a similar shape to those on the plunger so that there is a positive fit between them.

The jaws or other mechanism for making the positive drive connection between the drive mechanism and the plunger are preferably carried on a split collet type of structure so that they are journalled upon the plunger and can move axially thereon when disengaged. The jaws are normally urged apart by a compression spring or other bias means acting radially outwardly so that they adopt the disengaged position. In a preferred construction, the jaws extend transversely to either side of the plunger and a transverse coil compression spring is held between the jaw extensions at each side of the plunger. The springs can be held within a retaining extensible saddle piece formed integrally with each jaw extension for ease of assembly of the jaw mechanism. Alternatively, the jaws can be carried via leaf spring mountings from the collet or from another part of the drive mechanism.

Means are provided whereby a user can move the drive mechanism axially to set the dose required and to drive the plunger forward. Preferably, the forward drive is by means of a button or the like operatively associated with the plunger and extending axially from the rear end of the device, but others forms of forward drive means can be used. For example, the drive mechanism or a part operatively associated therewith can carry a radial arm which extends through an axial slot in the housing of the device, or a screw type mechanism can be used.

However, a particularly preferred form of drive mechanism comprises the radially moveable jaws described above carried by a split collet assembly journalled on the plunger and having springs or other bias means for urging the jaws radially outwards. The collet or the rear faces of the jaws themselves are acted on by an axially reciprocateable push sleeve journalled upon the plunger. The push sleeve extends rearwardly to provide a push button mounting projecting from the rear of the device so that depression of the button causes the push sleeve and hence the jaws to move axially to drive the plunger forward. If desired, the push button or push sleeve can be recessed within the terminal portion of the housing so that a user must insert some implement, for example a removable nose cap protecting the needle of the cartridge, to be able to operate the forward drive.

The drive mechanism is engaged or disengaged by some means which requires a positive operation by the user of the device so that the drive cannot be accidentally actuated or over-ridden. Thus, where the plunger has two or more flatted surfaces, these can be inset radially from the non-flatted surfaces so that the teeth on the jaws, or the balls in a Torrington type drive coupling as described above, would not engage the flatted surfaces. The drive can therefore be disengaged by rotating the jaws or a part operatively associated therewith, for example the push sleeve described above, to align the jaws with the flatted faces, or vice versa, by a tangential movement. In this position the drive mechanism is disengaged and can move relative to the plunger, for example when it is desired to set the dosage to be dispensed. The positive operation required by the user is to rotate the push sleeve or the protruding push button connected thereto with respect to the drive mechanism and this action has to be reversed before the drive can be re-engaged.

However, a preferred form of disengagement mechanism is a cam or other radially acting mechanism which moves the drive mechanism radially in and out of engagement with the plunger. Thus, the opposed jaws described above can be moved in and out by a cam carried internally on a rotating sleeve portion of the housing within which the operating mechanism of the device is housed. In this case, the rotatable sleeve section provides both the disengagement means (the internal cams) and the actuation means (the section of the housing itself carrying the cams) in a single member.

The cams acts against the spring or other bias holding the jaws clear of the plunger and brings the jaws into engagement with the plunger. The cams also retain the jaws in the engaged position, thus locking the drive connection between the drive mechanism and the plunger, until the cams are released by rotating the sleeve section carrying them. Alternatively, the jaws can be tied to the cams so that they are moved radially in both directions by the cams without the need for a spring bias. A further form of drive disengagement and actuation mechanism is an axial or tangentially mounted lever which is mounted by means of a pivot within the wall of the housing. Raising one end of the lever causes the other end to bear radially against the jaws or other radially moveable component of the drive mechanism either directly or via an intermediate component so as to urge them radially inward and into engagement with the plunger.

Where a rotatable cammed housing section is used, it is preferred that the exterior of this section carry mark-

ings or have an oval cross-section so that a user can tell the orientation of the section simply by touch.

The device incorporates a dosage selection mechanism for selecting the extent of axial travel of the disengaged drive mechanism so as to control the movement of the plunger and hence the volume of fluid discharged from the cartridge. The drive is then re-engaged and the drive mechanism returned to the datum point carrying the plunger with it. In this way the plunger moves an amount which is set by the extent to which the drive mechanism is retracted from a datum point. Since the drive is disengaged during the retraction of the drive mechanism, it is possible to correct any over- or under-shoot in the movement of the drive mechanism before the drive is re-engaged. Also, once the drive has been re-engaged, due to the fact that the plunger does not readily move rearwardly, as described below, the user cannot retract the drive mechanism or the plunger without positively disengaging the drive again. Hence tremulous or jerky operation of the device will not affect the dose to be dispensed.

The datum point for the dosage setting mechanism is preferably a stop determining the extent of forward travel of the drive mechanism or a part operationally associated therewith. Thus, the abutment of the push button driving the push sleeve against the end of the housing can provide that datum point. However, it is preferred that the datum point be provided by a stop located within the device against which the front face of the drive mechanism buts at the forward extreme of its travel. Conveniently, this stop is also the stop against which the rim of the cartridge seats when it is fitted to the device, so that the stop serves as the datum point both for positioning the cartridge to one side and for the dosage selection mechanism on the other.

The dosage selection means can operate axially, as when the push sleeve engaging the jaws described carries one or more external radial projections which but against co-operating projections carried by the housing within which the sleeve reciprocates. Rotation of the housing selects which stops will engage and hence the length of travel of the drive mechanism. Alternatively, the dosage selection mechanism can take the form of a side arm carried by the push sleeve and protruding through a stepped track or aperture in the wall of the housing which allows the sleeve to be retracted for the full length of one axial section of the track. The sleeve or a part operatively associated therewith then has to be rotated to allow the arm to move transversely into the next section where a larger dose is required.

However, we have found that a screw mechanism provides a particularly effective and accurate means for retracting the drive mechanism. Thus, for example, the dosage selection means utilises a screw sleeve journalled upon the push sleeve. The screw sleeve carries an external projection or screw thread which co-operates with an internal screw thread on the housing wall. Alternatively, the screw sleeve can have a radial projection which is journalled in a helical track or aperture in the wall of the housing of the device, or vice versa.

The screw thread can have any suitable pitch having regard to the axial movement required to achieve the minimum dose to be administered. The optimum pitch can readily be determined by simple trial and error having regard to the geometry of the device, for example so that $\frac{1}{4}$th of a turn of the screw sleeve achieves an axial travel corresponding to the axial distance between adjacent teeth on the plunger.

The screw sleeve has means by which it can be rotated by the user, for example by means of a pin or arm projecting through the wall of the device; or preferably by a collar located adjacent the end of the housing. This is connected to the sleeve through a spline coupling or the like to allow relative axial movement between the collar and the sleeve.

The forward movement of the plunger may be achieved by returning the dosage selection mechanism, for example the screw sleeve, to the datum point when the drive is re-engaged. However, this may not be easy or convenient, notably where this requires the user to rotate part of the device to achieve this, and it is preferred to employ an axial push action, e.g. by means of the push sleeve as described above. We therefore prefer that the dosage selection mechanism be demountably connected to the drive mechanism so that, when the drive is re-engaged, the connection between the dosage selection and the drive mechanisms is released. This can be conveniently achieved by providing a latch mechanism at or adjacent the forward end of the dosage selection mechanism, e.g. the screw sleeve, which latch mechanism engages the drive mechanism when the latter is in the disengaged position but which releases the drive mechanism when the latter is in the engaged position. The drive mechanism can then be driven forward independently of the dosage selection mechanism. Suitable latch mechanisms can readily be devised having regard to the specific design of the device they are to fit.

The device also comprises means whereby the dosage corresponding to a selected extent of retraction of the drive mechanism can be observed aurally or visually by a user, for example by means of a clicker mechanism. Preferably, the push sleeve or the screw sleeve carries markings correlating the dosage with the extent of axial movement. Where a screw sleeve is used, the markings are carried along a spiral path and are progressively brought into register with a window or port in the wall of the housing so that the user can see what dose is to be dispensed.

In order that a user can determine whether or not sufficient fluid remains within the container to achieve a stated amount to be dispensed, it is preferred to provide a second stop means carried by the plunger, for example at the rearward end thereof, which is engaged by the drive mechanism or push member as it is retracted. The second stop will prevent the drive mechanism or push member from being withdrawn to its full extent if the residual potential travel of the plunger is less than the desired dose. A user will detect resistance to operation of the dosage selection mechanism or will notice when the spline drive between collar 10 and the screw sleeve is over-ridden when this occurs. The user can then tell from the dose indicated as described above whether there is sufficient medicament in the cartridge to complete the required dose.

As indicated above, the plunger should not be free to move rearwardly during normal use of the device. This can be achieved by ensuring that the plunger is a frictional fit within the device. However, this may require excessive force to operate the device if the frictional forces are to overcome attempts to retract the plunger when the drive mechanism is engaged. We therefore prefer to provide some form of one way device to provide positive means for preventing the plunger from

moving rearwardly when a cartridge is mounted on the device. Conveniently, this means takes the form of a second pawl arrangement which engages with the teeth on the plunger shank at the forward end of the device. Whilst this pawl can be permanently engaged, it is preferred that it be is biassed so as to be disengaged from the plunger when no cartridge is in position. This enables the plunger to be retracted when a cartridge has been removed from the device so that a new one can be fitted. When the cartridge is mounted on the device, it or its housing causes the second pawl to re-engage with the teeth on the plunger.

The device of the invention can be provided with other features to enhance its use. For example, the device can be put up in the form of a pen type object with a cap over the needle end of the device and a clip for mounting it in the pocket of the user.

From the above, it will be seen that from one aspect, the present invention provides a device for dispensing a controlled amount of fluid from a container, which device comprises an assembly adapted to be mounted upon a container in which a plunger is adapted to be moved axially along the container in increments so as to drive a piston within the container and thus to dispense fluid from the container, characterised in that the assembly comprises a drive mechanism adapted to be reciprocated axially of the device and to be positively engaged with the plunger for the forward stroke of the drive mechanism so as to prevent relative movement between the plunger and the drive mechanism and to move the plunger forward in the container, which drive mechanism requires a positive action to disengage it from the plunger so as to permit relative movement of the plunger and drive mechanism for at least rearward movement of the drive mechanism; in that the forward travel of the drive mechanism is limited by a fixed stop mechanism; and in that the extent of the forward stroke of the drive mechanism is selected by withdrawing the drive mechanism a selected distance from the said fixed stop.

From a preferred aspect, the invention provides a device for dispensing a controlled amount of fluid from a container by means of a piston journalled in said container, which device is characterised in that it comprises:

a. an elongated generally cylindrical hollow body member having its forward end adapted to receive and retain the fluid container;

b. a plunger extending axially within said body member and adapted to be moved axially in a series of individually selected increments and to bear against the piston within the container when mounted on the said body member so as to move the said piston to dispense doses of fluid from the container at each incremental movement of the plunger;

c. a radially acting jaw member adapted to be moved into engagement with the said plunger to provide a positive drive connection between said jaw and said plunger, and to be disengaged from said plunger so as to permit relative axial movement between said plunger and said jaw;

d. means requiring positive operation by a user of the device for engaging or disengaging said jaw from said plunger.

e. an axially acting push sleeve journalled upon said plunger for moving said jaw forward when engaged to said plunger;

f. axially acting dosage selection means comprising a screw thread moved sleeve journalled for axial movement upon said push sleeve and carrying demountable means for engaging said jaw when said latter is disengaged from said plunger and for moving it rearwardly from a datum point so as to select the possible extent of forward travel of said plunger and to release said jaw when said jaw is re-engaged with said plunger for axial movement by said push sleeve; and

g. means for rotating said screw sleeve so as to select the extent of rearward movement of said screw sleeve from said datum point.

The invention also provides a device of the invention having mounted thereon a container, notably a cartridge, containing a medicament; and a medicament cartridge for use with the device, notably one housed within a housing adapted to be secured to the front end of the device of the invention.

The invention yet further provides a method for administering a fluid medicament to a patient using a device of the invention.

DESCRIPTION OF THE DRAWINGS

The device of the invention will now be described by way of illustration with respect to a preferred form thereof as shown in the accompanying drawings in which

FIG. 1 is an overall external diagrammatic view of the device;

FIG. 2 is a cross-sectional diagrammatic view through the device of FIG. 1;

FIG. 3 is a cross-sectional diagrammatic view through an alternative form of the device showing some of the components in greater detail; and

FIG. 4 is a part cut away/part perspective view of the device.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

The device comprise an elongated generally cylindrical housing 1 having an axial socket at one end into which a generally cylindrical cartridge 2 can be screw or push fitted. The cartridge typically has a cylindrical clear plastics or glass barrel with a hypodermic needle 3 protruding substantially co-axially from the free end thereof. A piston 4 journalled within the cartridge 2 is incrementally moved by a plunger 5 extending substantially co-axially rearwardly into the housing 1 of the device. The plunger 5 is separate from the piston and forms part of the device of the invention.

As shown in FIG. 3, the cartridge 2 can be housed in a housing 2a which is a screw fit into a collar 2b extending axially from the front end of the housing 1.

The rim of the cartridge seats against a circumferential radial shoulder or series of radial projections 20 carried internally by the housing 1 so as to locate the cartridge at a consistently fixed position with respect to the dosage selection mechanism as described below.

The device is provided with a pawl type one way mechanism which engages teeth on the plunger so as to prevent rearward movement of the plunger 5 once the cartridge is in place. This one way mechanism is shown diagrammatically as 21 in FIG. 2 and is biassed to retract radially when the cartridge is removed. For example, the housing can incorporate a twist mechanism which both locks the cartridge in position and actuates the one way mechanism; or the rim of the end of the cartridge or its housing can bear against part of the one way mechanism as it seats home to actuate the one way mechanism. The one way mechanism disengages when

the cartridge is removed to allow the plunger 5 to be retracted into the device to permit a new cartridge to be mounted on the device.

A preferred form of the one way mechanism 21 is shown in FIG. 3 and comprises a pair of diametrically opposed pawls 60 carried on spring arms 61 snap fitted onto the annular shoulder 20 to extend forward of the shoulder into the axial socket in which the cartridge is mounted. The pawls 60 have an inclined rearward face 62 which bears against a correspondingly angled face carried by a split collet 63 mounted around the plunger shank and radially inward of arms 61. The collet is attached to a spring loaded sleeve 64 which is a slideable fit within the socket and is spring biassed into its forward position. The front end of the sleeve 64 provides a stop 65 against which the rim 66 of the housing 2a bears as it is mounted in the device. This causes the sleeve 64 to be moved axially rearwardly to carry the inclined face of collet 63 clear of the inclined face 62 of the pawl and to bring the rear edge of collet 63 into contact with a stop 67 carried on the radially inward face of arc 61. This causes the arm 61 to flex radially inward and urge pawl 60 into engagement with the teeth on the plunger. When the housing 2a is removed to fit a new cartridge 2, this allows the sleeve 64 to move forward under the thrust of the spring so that collet 63 moves forward to release stop 67 and bears against the inclined face 62 to lift the pawl 60 clear of the teeth on the plunger. The plunger can now be retracted into the device to enable another cartridge to be fitted. By using the rear of the accurately moulded housing 2a to actuate the pawl mechanism 60-67, rather than the rim of the cartridge 2, variations in the size of the cartridge can be accomodated.

Rearwardly of shoulder 20, the body of the device houses the plunger drive mechanism, the means for engaging and disengaging the drive mechanism from the plunger and the dosage selection means. In the form of the device shown, these take the form of a series of members concentrically journalled around the plunger 5.

As shown, the housing comprises a rotatable section 6 which houses the drive engagement mechanism; a fixed section 7 containing the dosage selection mechanism and having a port 8 through which a scale 9 indicating the dose selected can be seen by the user; a further rotatable collar or sleeve 10 for operating the dosage selection mechanism; and a terminal axially operating push button 11 for driving the plunger forward to dispense the selected dose. The various sections of the housing can have any desired external shape, but it is preferred that the housing 1, sleeve 6 and section 7 have an oval external cross-section so that the relative rotational position of one with respect to the other can readily be detected by a user, notably by a blind person.

The plunger 5 preferably has a substantially circular cross-section, but can have a squared, triangular or other cross-section shape if desired. For example, as shown in FIG. 4, it may have two opposed flats along its length to guide the drive means.

The plunger 5 carries a series of circumferential ribs or teeth 22 which form an axial ratchet into which the one way mechanism 21 and the radially clampable drive mechanism described below engage. The teeth 22 are of a saw tooth form with the scarp face of the teeth directed rearwardly. Preferably, the teeth extend axially for the full length of the plunger 5. As indicated above, it is preferred that the axial distance from one tooth to the next corresponds to a dosage unit for the material being dispensed.

Located to the rear of shoulder 20 is the drive mechanism and the mechanism for engaging and disengaging this from the plunger. The drive mechanism is a pawl type mechanism which is radially engageable and disengageable with the teeth on the plunger and comprises two jaws 23 and 24 diametrically opposed to one another and carrying on their radially inward faces teeth which correspond to and engage with the teeth 22 on the plunger.

The jaws are normally urged radially outwardly, as shown for jaw 24 in FIGS. 2 and 3, by transverse coil springs acting between the jaws 23 and 24 or by other bias means (not shown) so that their teeth do not engage those of the plunger, which is then free to move axially with respect to the jaws when they are in their outward position, but is locked to the jaws when they are in their radially inward position, as shown for jaw 23 in FIGS. 2 and 3.

The jaws are moved radially inward against the thrust of the coil springs by a pair of cams 6a carried on the internal face of the rotatable section 6 of the housing or formed by the narrower diameter sectors of the oval cross-section of the rotatable section 6. The user has to twist section 6 to engage or disengage the jaws from plunger 5 and thus engage or disengage the drive to the plunger. If desired, section 6 can be spring biassed towards the drive disengaging position so that the user always has to twist section 6 before the device can be used.

The shoulder 20, as shown in FIGS. 2 and 3, defines the forward limit of the travel of the drive mechanism and provides the datum point from which the dosage is determined. In the device shown in FIGS. 2, 3 and 4, the forward faces of jaws 23 and 24 but against the rear face of shoulder 20 to set the zero or datum point for the dosage selection mechanism.

A push sleeve 25, journalled on plunger 5 and within the dosage selection mechanism described below, acts axially on the rear faces of the jaws 23 and 24 when in their drive engaged position to drive the jaws and hence the plunger 5 forward. When the jaws are in the drive disengaged position, they still bear against the push sleeve so that they carry it axially rearwards with them during the dosage selection. The push sleeve 25 provides the mechanical link between the terminal push button 11 which a user presses and the jaws 23 and 24.

The jaws 23 and 24 are moved axially by means of a split jaw drive sleeve 26 which has forward hooks 27 which engage similar recesses 28 at the rear of the jaws and rearward hooks 29 or other flexible linkages which connect the sleeve 26 axially to the forward end of the screw sleeve 30 of the dosage selection mechanism. When the jaws are in the drive disengaged position as shown for jaw 24 in FIGS. 2 and 3, the hooks 27 and recesses 28 are engaged and the jaws can be moved axially with the screw sleeve 30. When the jaws are in the drive engaged position, as shown for jaw 23 in FIGS. 2 and 3, the hooks 27 are released from recesses 28 to permit the jaws to move axially with sleeve 25 and free from the screw sleeve 30 (as shown in FIG. 3).

The dosage selection mechanism is housed within section 7 of the housing and comprises a screw sleeve 30 journalled for rotation and axial movement upon push sleeve 25. Sleeve 30 carries an external screw thread 31 which engages a similar thread 32 carried internally by section 7 of the body of the device. Sleeve 30 is rotated

and thus caused to move axially by means of collar 10 driving the sleeve through a spined drive 33 shown in FIGS. 2 and 3. Collar 10 or the window insert in port 8 preferably has a ratchet or clicker mechanism 34 to give an audible indication as the dose is selected.

Retraction of sleeve 30 carries the jaw drive sleeve 26 and the jaws 23 and 24 with it when they are in the disengaged position and the dose selected can be seen through port 8. Re-engagement of jaws 23 and 24 with the plunger, breaks the latch 27/28 and allows the push sleeve 25 and the jaws 23 and 24 to move independently of the screw sleeve 30 and the jaw drive sleeve 26.

To indicate when there is insufficient fluid left in the cartridge to achieve the next dose, a radial shoulder or stop 50 is located at or adjacent the rearward end of plunger 5. This co-operates with a corresponding stop or shoulder 51 at the forward end of the push sleeve 25. The stops engage when the push sleeve is retracted to the maximum extent possible as the plunger 5 approaches the extreme of its forward travel. The user can then see from the dose displayed at the port 8 whether the cartridge contains the requisite amount of fluid. Since the plunger drive is not engaged at this time, the user can then set the dosage mechanism to the required dose if this is less than the amount indicated as remaining in the cartridge without having to discharge fluid as with a conventional device.

Push sleeve 25 is provided with a push button end cap 11 protruding axially from the body of the device which the user depresses to drive the sleeve 25 forward within the housing until the front faces of jaws 23 and 24 but against the rear of shoulder 20. The jaws 23 and 24 can only be moved rearwardly when they have been disengaged from the teeth 22 on the plunger 5, since the one way mechanism 21 will prevent rearward movement of the plunger 5. If a user attempts to set the dosage mechanism whilst the drive is engaged, he will detect resistance to rotation of sleeve 10. If he ignores this, the spline drive 33 between collar 10 and the screw sleeve 30 will be over-ridden to release the screw sleeve to prevent damage to the mechanism. However, unless the drive is engaged, depression of button 11 will not achieve any forward movement of the jaws or discharge of fluid from the cartridge 2.

The above device can be manufactured in many suitable materials and readily lends itself to manufacture by injection moulding of suitable plastics materials with the various components being snap fits upon one another.

In operation, a user rotates the sleeve 6 to disengage the drive mechanism. Jaws 23 and 24 should be seated against the rear face of shoulder 20, the zero setting, from the previous use of the device, but the screw sleeve 30 will be at the dosage position previously selected. The user can thus see what dose was last administered where a sequence of different doses has to be administered. Sleeve 10 is rotated, say clockwise, to bring sleeve 30 to its forward position at which the latching mechanism 27/28 engages the jaws 23 and 24 and seats them firmly against the rear face of stop 20. The engagement of the latches can be used to provide an audible signal when this occurs, or the resistance to further forward movement will provide the signal to the user that the zero setting has been reached. The dosage displayed through port 8 will now read zero.

Sleeve 10 is then rotated anti-clockwise the desired number of turns, as evidenced by the number of clicks heard or by the dose displayed at the port 8, to retract screw sleeve 30, the jaw-drive sleeve 26 and the jaws 23 and 24 and the push sleeve 25 the desired distance with respect to plunger 5. This will also cause the push button 11 to be extended from the rear end of the device.

Sleeve 6 is then rotated to re-engage the positive drive between the push sleeve 25, the jaws 23 and 24 and the plunger 5. This action will also disengage the latch 27/28 between jaws 23 and 24 and the jaw drive sleeve 26. At this point the device is cocked and ready to dispense the desired dose from the cartridge. However, the device has required a series of positive actions to achieve this state and would not normally be retained by a user in the cocked state, but would be stored with the drive disengaged so that accidental actuation of the device can not occur.

The user then inserts the point of needle 3 into his arm, buttock or other suitible point in his body and depresses button 11 to administer the dose of insulin. The dose is administered by depressing the button fully. If the button is not depressed fully, the user can detect this and can complete the dose administration. If desired, a coloured band can be mounted around button 11 which will remain partially exposed until the button is fully depressed. Release of pressure on button 11 does not allow the plunger 5 to retract as with previous designs, so that jerky or interrupted depression of button 11 does not allow the user to pump the device to administer an excessive dose.

When the full dose has been administered, the jaws 23 and 24 will but against the rear of shoulder 20. Due to the action of the one way mechanism 21, 60-67, the blocks 23 and 24 can not be retracted and administration of a further dose of insulin is not possible until the whole process of dose selection and re-cocking of the device is carried out. The device will therefore resist accidental overdosing due to repeated pressing of button 11.

As stated above, the device of the invention finds use wherever it is desired to provide a measured dose syringe, for example in the administration of Other medicaments or in dispensing accurately known amounts of a fluid, for example in blood tests or analytical work. It will also be appreciated that the device may be altered in ways which do not affect the fundamental operating concept of the device, for example by using a short plunger within the device to drive an intermediate plunger linked to a plunger carried by the piston of the cartridge; or to incorporate a flexible drive between the plunger 5 and the piston 4 so that the device of the invention is mounted at an angle to the axis of the cartridge.

What I claim is:

1. A device for dispensing a controlled amount of fluid from a container, which device comprises an assembly adapted to be mounted upon a container in which a plunger is adapted to be moved axially along the container in increments so as to drive a piston within the container and thus to dispense fluid from the container characterised in that the assembly comprises a drive mechanism adapted to be reciprocated axially of the device and to be positively engaged with the plunger for the forward stroke of the drive mechanism so as to prevent relative movement between the plunger and the drive mechanism and to move the plunger forward in the container, which drive mechanism requires a positive action to disengage it from the plunger so as to permit relative movement of the plunger and drive mechanism for at least rearward movement of the drive mechanism; in that the forward travel of the drive

mechanism is limited by a fixed stop mechanism; and in that the extent of the forward stroke of the drive mechanism is selected by withdrawing the drive mechanism a selected distance from the said fixed stop.

2. A device as claimed in claim 1 which comprises:

a. a hollow body member having one end adapted to receive and retain the fluid container

b. a plunger carried by said body member and adapted to be moved axially in a series of increments and to bear against the piston within the container so as to move the said piston to dispense doses of fluid from the container at each incremental movement of the plunger

c. a push member carried by said body member for axial movement with respect to said body member and having means for achieving positive engagement with the said plunger in the forward direction of travel of the push member

d. means requiring positive operation for releasing said positive engagement and thus permitting relative axial movement between the push member and the plunger in at least the rearward direction of travel of the said push member

e. a stop means against which the push member or a part associated therewith butts at the extreme of the plunger's forward travel on each of its incremental movements

f. means for withdrawing the push member or its said associated part axially from the stop means to a selected distance whereby the extent of each incremental forward movement of the plunger can be selected

g. means for inhibiting rearward movement of the plunger whilst the container is located upon the body member

3. A device as claimed in claim 2 wherein there is provided a second stop means carried by said plunger which is engaged by the drive mechanism as it is retracted whereby the second stop member prevents the drive mechanism from being withdrawn to its full extent if the residual potential travel of the plunger is less than the desired dose.

4. A device as claimed in claim 1 wherein means are provided whereby the inhibition of the rearward movement of the plunger is removed or released when the container is removed from the body member.

5. A device as claimed in claim 4 wherein rearward movement of the plunger is prevented by a ratchet mechanism which is engaged by rotating part of the body member which also locks the container in position.

6. A device as claimed in claim 1 wherein the positive drive between the plunger and the drive mechanism is achieved by means of a radially acting mechanism which engages the shank of the axially reciprocable plunger member.

7. A device as claimed in claim 6 wherein the plunger has a series of ratchet teeth along its outer surface which are engaged directly or indirectly by a radially expansible toothed clamp member carried terminally by a sleeve push member journalled for axial movement within the device.

8. A device as claimed in claim 7 wherein the sleeve member is moveable axially by rotation thereof using a screw thread mechanism.

9. A device as claimed in claim 6 wherein the radially acting mechanism is actuated by rotation of a cam or similar mechanism to drive the radially acting mechanism radially inwardly into engagement with the plunger.

10. A device for administering insulin from a cylindrical cartridge having a piston journalled therein for axial movement along the cartridge to dispense the insulin contents of the cartridge through a needle outlet into the body of a user, which device comprises:

a. a cylindrical hollow body member having one end adapted to receive and retain the cartridge

b. a plunger journalled within the said body member and adapted to be moved axially in a series of increments and to bear against the piston within the container so as to move the said piston to dispense discrete and selectable doses of insulin from the cartridge at each incremental movement of the plunger

c. a generally cylindrical push sleeve journalled within the said body member for axial movement with respect to said body member

d. a pair of opposed clamp members mounted for radial movement within the said body member and which can be moved radially inwardly to positively engage the said plunger in the forward direction of travel of the push sleeve whereby the plunger is driven forward by the said sleeve, but which can be moved radially outwardly to disengage from the said plunger for the rearward movement of the said sleeve to permit relative axial movement between the push sleeve and the plunger in at least the rearward direction of travel of the said push sleeve

d. cam means operable from the exterior of the said body member and requiring positive operation for moving the said clamp members radially inward or outward

e. an inwardly directed shoulder within the body member which acts as a stop means against which the push member or the clamp members but at the extreme of the plunger's forward travel on each of its incremental movements

f. an external rotatable member co-axial with the said body member for rotating the said sleeve member and causing it to move axially under the influence of a screw thread mechanism co-operating between the said body and the said sleeve whereby the sleeve can be moved rearwardly to a selected extent from the said stop shoulder when the clamp members are disengaged from the said plunger and thereby select the extent of forward travel of the plunger when the clamp members are re-engaged with the plunger for forward movement thereof.

11. A hand portable device for dispensing a fluid from a container by means of the axial movement of a piston within the container under the influence of a plunger moved by the device, which device is adapted to receive the container at its forward end and to move the plunger axially forward toward the container so as to dispense a selected amount of fluid from the container upon each actuation of the device, characterised in that the device comprises a drive mechanism adapted to be reciprocated axially of the device and to be positively engaged with the plunger for the forward stroke of the drive mechanism so as to prevent relative movement between the plunger and the drive mechanism and to move the plunger forward, which drive mechanism requires a positive action to disengage it from the plunger so as to permit relative movement between the plunger and drive mechanism for at least rearward

movement of the drive mechanism; in that the forward travel of the drive mechanism is limited by a fixed stop mechanism; and in that the extent of the forward stroke of the drive mechanism is individually selectable for each actuation of the device by withdrawing the drive mechanism or a part operatively associated, therewith a selected distance from a fixed stop defined by said fixed stop mechanism.

12. A hand portable device for dispensing a fluid from a container by means of the axial movement of a piston within the container under the influence of a plunger moved by the device, which device is adapted to receive the container at its forward end and to move the plunger to dispense a selected amount of fluid from the container upon each actuation of the device, characterised in that the device by axially moving said drive mechanism a selected amount relative to said plunger while said drive mechanism is disengaged therefrom comprises:

i. a disengageable drive mechanism adapted to be reciprocated axially of the device and adapted to positively engage the plunger whereby the plunger can be moved axially forward by the drive mechanism and to be disengaged from the plunger to permit relative axial movement between the drive mechanism and the plunger;

ii. a disengagement means for selectively engaging or disengaging the drive means from the plunger;

iii. an actuating means, which may be the integral with or separate from the disengagement means, for actuating the disengagement means, which actuation means requires a positive operation from a user of the device to engage and/or disengage the drive mechanism from the plunger; and

iv. means for individually selecting the extent of travel of the drive mechanism for each actuation of the device so as to control the extent of axial movement, of the plunger upon actuation of the device.

13. A hand portable device for dispensing a fluid from a container by means of the axial movement of a piston within the container under the influence of a plunger moved by the device, which device is adapted to receive the container on its forward end and to move the plunger axially forward towards or within the container so as to dispense a selected amount of fluid from the container upon each actuation of the device, characterised in that the device comprises:

a. an elongated generally cylindrical hollow body member having its forward end adapted to receive and retain the fluid container;

b. a plunger extending axially within said body member and adapted to be moved axially in a series of individually selected increments and to bear against the piston within the container when mounted on the said body member so as to move the said piston to dispense doses of fluid from the container at each incremental movement of the plunger;

c. a radially acting jaw member adapted to be moved into engagement with the said plunger to provide a positive drive connection between said jaw and said plunger, and to be disengaged from said plunger so as to permit relative axial movement between said plunger and said jaw;

d. means requiring positive operation by a user of the device for engaging or disengaging said jaw from said plunger.

e. an axially acting push sleeve journalled upon said plunger for moving said jaw forward when engaged to said plunger;

f. axially acting dosage selection means comprising a screw thread moved sleeve journalled for axial movement upon said push sleeve and carrying demountable means for engaging said jaw when said latter is disengaged from said plunger and for moving it rearwardly from a datum point so as to select the possible extent of forward travel of said plunger and to release said jaw when said jaw is re-engaged with said plunger for axial movement by said push sleeve; and

g. means for rotating said screw sleeve so as to select the extent of rearward movement of said screw sleeve from said datum point.

14. A device as claimed in claim 11 wherein the plunger carries an axial series of transverse teeth and the drive mechanism carries corresponding teeth adapted to engage the teeth on the plunger when in the drive engaged position.

15. A device as claimed in claim 11 wherein the drive mechanism is actuated by a radially acting cam means which acts to move the mechanism radially inward to engage the plunger and to retain it in engagement with said plunger during forward movement of the plunger.

16. A device as claimed in claim 11 wherein the device is provided with means for positively acting on said plunger so as to prevent rearwards movement of said plunger at all times when a container is mounted on the device.

17. A device as claimed in claim 11 wherein said datum point is provided by a stop means against which a component selected from the drive mechanism and a part operatively associated therewith buts at the extreme of the forward travel of plunger on each of its incremental movements.

18. A device as claimed in claim 11 wherein there is provided a second stop means carried by said plunger which is engaged by a component selected from the drive mechanism and a part operatively associated therewith as it is retracted, whereby the second stop member prevents the drive mechanism from being withdrawn to its full extent if the residual potential travel of the plunger is less than the desired dose.

19. A device as claimed in claim 11 having a container containing a medicament is mounted at its forward end.

* * * * *

Docket No. 5533.200-US

3763

SKADDEN, ARPS, SLATE, MEAGHER & FLOM
Four Times Square
New York, NY 10036-6522

Telephone: (212) 735-3020
Facsimile: (917) 777-3020

T-H.
6-14-01
#10 / Ext 07
time (3 mos)

Date: June 6, 2001

Applicant(s)	:	Buch-Rasmussen et al.	
Serial No.	:	09/349,748	Examiner: Simmons, K.
Filed	:	July 8, 1999	Art Unit: 3763
Title	:	Medical Device	

AMENDMENT TRANSMITTAL
AND REQUEST FOR EXTENSION OF TIME

Assistant Commissioner For Patents
Washington, DC 20231

Sir:

I hereby certify that this paper is being deposited with the United States Postal Service, as first class mail, in an envelope addressed to: Assistant Commissioner for Patents, Washington, DC 20231, on June 6, 2001.

Robert B. Smith — Reg. No. 28,538

Robert B. Smith — Signature

June 6, 2001 — Date

Transmitted herewith is an AMENDMENT in the above-identified application.

1. ( ) No additional fee is required.

06/11/2001 TGEDAHU1 00000044 192385 09349748
01 FC:217 890.00 CH

(3 mos)

2. ( ) The fee has been calculated as shown below:

Claims remaining	Prior Paid Claims	Extra	Rate	Fee
Total:	minus (at least 20) =	@	$18	= $
Independent	minus (at least 3) =	@	$80	= $___

TOTAL ADDITIONAL FEE: $

3. (X) An extension of time to respond to the PTO Communication dated December 7, 2000 is hereby requested. The required fee is indicated below:

Within first month:	( )	$110
Within second month	( )	$390
Within third month	(X)	$890
Within fourth month	( )	$1,390

4. ( ) The Amendment includes an Information Disclosure Statement. Enclosed is Form PTO-1449 and copies of ____ reference(s).

5. (X) The Commissioner is hereby authorized to charge the amount of $ 890.00 representing (a) additional claims fee ($); (b) the extension fee ($ 890); and (c) the fee for filing an Information Disclosure Statement ($) to deposit account No. 19-2385. A copy of this sheet is enclosed for such purpose.

6. (X) In the event that an extension of time is required and applicant has inadvertently overlooked the need to request a petition and file the fee, the applicant hereby petitions for such extension of time. The Commissioner is authorized to charge the required fee to deposit account No. 19-2385. A copy of this sheet is enclosed for such purpose.

7. (X) The Commissioner is hereby authorized to charge payment of any additional fees required in connection with this application, and credit any overpayment, to deposit account No. 19-2385. A copy of this sheet is enclosed.

Skadden, Arps, Slate, Meagher & Flom

By Robert B. Smith

Robert B. Smith
Registration No. 28,538
Attorneys for Applicant(s)
(212) 735-3020

Docket No. 5533.200-US

T-14 6-14-01 #11 Amdt B

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s)	:	Buch-Rasmussen et al.	
Serial No.	:	09/349,748	Examiner: Simmons, K.
Filed	:	July 8, 1999	Art Unit: 3763
Title	:	Medical Device	

I hereby certify that this paper is being deposited with the United States Postal Service, as first class mail, in an envelope addressed to: Assistant Commissioner for Patents, Washington, DC 20231, on June 6, 2001.

Robert B. Smith — Reg. No. 28,538

Robert B. Smith — Signature

June 6, 2001 — Date

June 6, 2001

AMENDMENT

Assistant Commissioner For Patents
Washington, DC 20231

Sir:

In response to the Office Action dated December 7, 2000, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Replace the paragraph appearing on page 1, lines 15-23 with the following paragraph:

B

One prior art medication delivery pen includes a pen body assembly comprising a medication cartridge and a plunger device. A needle assembly may be connected to the pen body assembly. The medication is delivered by moving or pressing a plunger in the direction of the needle assembly, thereby delivering the medication. When the medication in the cartridge is exhausted, the pen body assembly is discarded. Depending on the medication needs for each individual the medication in the cartridge will last for several days. During this period the needle assembly will often have to be replaced by a new assembly or new needle due to increasing bluntness of the needle making injections painful for the patient.

Replace the paragraph appearing on page 6, lines 8-14 with the following paragraph:

The dosing assembly 6 is illustrated in Figs. 1 and 2. It is understood, however, that the dosing assembly 6 according to the invention may be any suitable dosing unit including plunger means and, accordingly, that variations from the depicted embodiment may be provided, and are considered to be within the scope of this invention. In the depicted embodiment, the dosing assembly 6 includes a cylindrical housing 17 surrounding the plunger means of the dosing unit and having opposed proximal and distal ends.

Docket No. 5533.200-US

IN THE CLAIMS:

Replace claim 1 with the following claim:

1. (Amended) A medication delivery device comprising:

a cartridge assembly having a distal end and a proximal end, said distal end of the cartridge assembly comprising coupling means for releasably mounting a needle assembly, and said cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a plunger means for acting on said stopper and a dose-setting and injection mechanism for setting a specified dose and for driving said plunger means to deliver the selected dose, and

a needle assembly including a coupling means for engaging the coupling means of said cartridge assembly to form a releasable coupling between said needle assembly and said cartridge assembly,

wherein the cartridge assembly and the dosing assembly are releasably coupled together, and wherein the combination of couplings between the dosing assembly and the cartridge assembly, and between the needle assembly and the cartridge assembly, respectively, is selected to secure that the plunger means abuts on the stopper during coupling and decoupling of the needle assembly.

Add the Following New Claims (19-33):

19. A medication delivery device according to claim 1, wherein the plunger means comprises a rod element adapted to exert an axial movement on the stopper towards the sealed end of the cartridge.

20. A medication delivery device according to claim 19, wherein the means for releasably coupling the dosing assembly and the cartridge assembly together are such that the coupling and decoupling of the needle assembly does not cause an axial movement of the cartridge assembly with respect to the dosing assembly.

21. A medication delivery device according to claim 20, wherein the dosing assembly is released from the cartridge assembly through a movement including an axial movement.

22. A medication delivery device according to claim 21, wherein the dosing assembly is released from the cartridge assembly through a threaded coupling.

23. A medication delivery device according to claim 1, wherein the dosing assembly comprises a scale.

24. A medication delivery device according to claim 1, wherein the dosing assembly comprises a dose setting mechanism for setting a selected dose of medication to be delivered.

25. A medication delivery device according to claim 1, wherein the cartridge assembly comprises a housing.

26. A medication delivery device according to claim 1, wherein the cartridge assembly includes a cartridge which is unitarily molded with at least one coupling means.

27. A medication delivery device according to claim 1, further comprising a cap for protecting the needle assembly and/or cartridge assembly.

28. A medication delivery device comprising:

a cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a plunger means for acting on said stopper and a dose-setting and injection mechanism for setting a specified dose and for driving said plunger means to deliver the selected dose, and

a needle assembly,

a first releasable coupling between the needle assembly and the cartridge assembly, and

a second releasable coupling between the cartridge assembly and the dosing assembly, wherein said first and second releasable couplings are of different types such that releasing or attaching said needle assembly onto said cartridge assembly does not urge said second releasable coupling to disengage.

29. A medication delivery device according to claim 28, wherein said first and second couplings are each selected from the group consisting of snap locks, snap locks with guide wire, sideways snap locks, snap locks released through threads, bayonet couplings, luer locks, hinged locks and threads.

30. A medication delivery device according to claim 28, wherein said device has a longitudinal axis, wherein one of said couplings is disengaged through a relative twisting force about said axis, and wherein the other of said couplings is disengaged through a force other than twisting about said axis.

31. A medication delivery device comprising:

a cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a housing and a plunger means movable relative to said housing for acting on said stopper,

a needle assembly,

a first releasable coupling between the needle assembly and the cartridge assembly, and a second releasable coupling between the cartridge assembly and the dosing assembly housing, wherein said first and second releasable couplings are of different types such that releasing or attaching said needle assembly onto said cartridge assembly does not urge said second releasable coupling to disengage.

32. A medication delivery device according to claim 31, wherein said first and second couplings are each selected from the group consisting of snap locks,

snap locks with guide wire, sideways snap locks, snap locks released through threads, bayonet couplings, luer locks, hinged locks and threads.

33. A medication delivery device according to claim 31, wherein said device has a longitudinal axis, wherein one of said couplings is disengaged through a relative twisting force about said axis, and wherein the other of said couplings is disengaged through a force other than twisting about said axis.

REMARKS

By the foregoing amendments, two minor changes have been made to the specification. Claim 1 has been rewritten to specify that the coupling between the cartridge assembly and dosing assembly is releasable, and to specify that the dosing assembly includes a mechanism to set the dose and drive the plunger means. Also, the language concerning the means for securing that the plunger remain in contact with the stopper has been rewritten for clarity, but such limitation is believed to have the same scope as in original claim 1. The dependent claims recite various limitations of original dependent claims 2-12. Finally, new independent claims 28 and 31, and dependent claims 29-30 and 32-33 are presented. Favorable consideration of the amended claims is respectfully requested in light of the following remarks.

The present invention is directed to a specific type of medication delivery device, namely, one in which both the needle assembly and the cartridge are replaceable, but in which the needle needs to be replaced more often than the cartridge. In known devices of this type, the cartridge is sealed at its forward end by a pierceable seal, and at its other end by a slideable rubber stopper. In order to inject a dose of medicine, a double pointed needle is mounted on the forward end of the cartridge assembly such that its proximal end penetrates the seal. A plunger rod, whose forward end abuts the rubber stopper, is then advanced a specified distance to push the stopper forward and eject a corresponding dose of medicine out through the

needle. In order to set the size of the dose, such devices typically include a dose-setting mechanism which will ensure that the piston rod advances a distance exactly corresponding to the size of the desired dose.

In order to deliver a precise dose, it is critical that the plunger rod, during normal use of the device (i.e., except when replacing the cartridge) remain in contact with the rubber stopper. In other words, if, between injections, a gap develops between the forward end of the piston rod and the stopper, when the next injection is made an incomplete dose will be delivered, because part of the plunger's movement will be closing such gap, rather than pressing the rubber stopper forward.

As discussed in the specification, EP 688,571 (the U.S. counterpart of which is patent No. 5,725,508) discloses a syringe having a replaceable cartridge holder, which contains a cartridge, and a replaceable needle assembly. The cartridge holder is coupled to the syringe body by threads. The needle assembly is also coupled to the syringe body by threads. Such syringe is designed to provide multiple injections from the same cartridge, and such that the needle assembly will be replaced several times before the cartridge needs to be replaced (insulin needle manufacturers in fact recommend replacing the needle after each injection).

Because the same type of coupling, i.e., a threaded coupling, is used for both connections, there is the possibility that, when the needle assembly is unscrewed from the syringe, the cartridge holder might become partially unscrewed

from the syringe body. If that were to occur, a gap would form between the plunger rod and the rubber stopper.

Claim 1 as amended is directed to a device which includes a dose-setting and injection mechanism in which the size of the dose to be administered is set prior to the injection, and in which the mechanism advances the plunger means, e.g., plunger rod 7, to expel the set dose. In this manner, the device can be used to inject multiple injections from each cartridge, with the needle assembly being changed as often as needed. A pair of releasable couplings are provided between the needle assembly and cartridge assembly and between the cartridge assembly and dosing assembly, respectively. While either coupling can be any type of suitable coupling, Specification page 4, lines 15-16, the combination is selected to secure that the plunger means abuts on the stopper during coupling and decoupling of the needle assembly. In other words, once one coupling is chosen, the other coupling is selected so that the disengagement mechanisms of the two couplings act independent of one another, so as to ensure that coupling or decoupling of the needle assembly/cartridge assembly coupling does not cause the other coupling to disengage or partially disengage.

Original claim 1 was rejected as anticipated by Reynolds U.S. patent No. 5,364,369. Reynolds discloses a two-component syringe for mixing dry and wet components, and injecting the mixture. In particular, referring to Figures 3 and 4 of Reynolds, the Reynolds device includes a vial 6, having a seal 5 at its forward end

and a slidable stopper 18 at its rear end. A dry medicament is held in the sealed space between the seal 5 and the stopper 18.

A capsule 14 is provided holding the liquid component to be mixed with the dry component. In order to mix the components, a cap 12, containing a double pointed needle 44, is positioned over the forward end of the capsule 14, but such that its needle 44 also does not initially penetrate the capsule 14. The cap 12 and capsule 14 are then inserted into a sleeve 10, which sleeve is screwed onto the stopper 18. Thereafter, the capsule 14 is pressed into the sleeve 10, so that the needle 44 penetrates both the capsule and a septum in the stopper 18. The liquid component can then be squeezed out of the capsule 14 and into the compartment holding the dry component, as shown in Figure 4.

Once the components have been mixed, the capsule 14 and cap 12 are withdrawn from the sleeve 10, as shown in Figure. 5, and discarded. Another cap 2, containing a backward pointing needle 22, is positioned over the forward end of the vial 6, but such that the needle 22 does not initially penetrate the seal 5. Finally, as shown in Figure 6, after mounting an optional injection needle 28 on the cap 2, the user simultaneously grabs the flanges 24 and 26 on the sleeve 10 and the cap 2, respectively, and squeezes the flanges 24, 26 towards one another. The action of pulling the cap 2 backwards causes the needle 22 to penetrate the seal 5, thereby establishing an outlet for the mixed contents in the vial 6 through the needles 22 and

28. The action of pushing the sleeve 10 forward pushes the stopper 18 forward to discharge the contents of the syringe out through the needle 28.

Reynolds discloses, as an option, that the cap 2 can be mounted on the vial 6 by threads. Reynolds col. 8, lines 13-20. Thus, either there is no coupling between the cap 2 and vial 6, or both the cap 2 and the sleeve 10 are coupled to the vial 6 by the same type of coupling, i.e., threads. Moreover, Reynolds does not disclose any mechanism for setting the size of the dose or for pressing the sleeve 10 forward. For such reasons, the applicants respectfully submit that Reynolds does not disclose the apparatus recited in amended claim 1

Also, in Reynolds, the entire dose is delivered in one injection. Thus, the possibility that the coupling between a dosing assembly and a cartridge assembly might partially disengage while mounting or removing a needle assembly is not a concern. For such reasons, the applicants respectfully submit that Reynolds also does not suggest the apparatus recited in amended claim 1, and favorable consideration and allowance of claim 1 are respectfully requested.

New independent claim 28 also recites a device with a dose-setting and injection mechanism. New independent claim 31 recites that the dosing assembly includes a housing, which is coupled to the cartridge assembly, and a plunger which is movable relative to the housing. In addition, such claims recite that the first and second couplings, between the needle assembly/cartridge assembly and cartridge assembly/dosing assembly, respectively, are of different types so as not to interact

with one another. Such features are not disclosed or suggested in Reynolds, and favorable consideration of such claims are respectfully requested.

Favorable consideration and allowance of the dependent claims are respectfully requested for the reasons set forth in the parent claims, as well as the additional novel features recited therein.

For the reasons discussed above, entry of the proposed amendments, and favorable reconsideration and allowance of the application, are respectfully requested.

Respectfully submitted,

Robert B. Smith
PTO Registration No. 28,538
Attorney for applicant(s)

Skadden, Arps , Slate, Meagher, & Flom
Four Times Square
New York, NY 10036-6522
(212) 735-3020

Docket No. 5533.200-US

VERSION WITH MARKINGS TO SHOW CHANGES MADE

CHANGES IN THE SPECIFICATION:

Paragraph appearing on page 1, lines 15-23:

One prior art medication delivery pen includes a pen body assembly comprising a medication cartridge and a plunger device. A needle assembly may be connected to the pen body assembly. The medication is delivered by moving or pressing a plunger in the direction of the needle assembly, thereby delivering the medication. When the medication in the cartridge is exhausted, the pen body assembly is discarded. Depending on the medication needs for each individual the medication in the cartridge will last for several days. During this period the needle assembly will often have to be replaced [displaced] by a new assembly or new needle due to increasing bluntness of the needle making injections painful for the patient.

Paragraph at page 6, lines 8-14:

The dosing assembly 6 is illustrated in Figs. 1 and 2. It is understood, however, that the dosing assembly 6 according to the invention may be any suitable dosing unit including plunger means[,] and, accordingly, that variations from the depicted embodiment may be provided, and are considered to be within the scope of this invention. In the depicted embodiment, the dosing assembly 6 includes a cylindrical housing 17 surrounding the plunger means [17] of the dosing unit and having opposed proximal and distal ends.

B

CHANGES IN THE AMENDED CLAIMS

1. (Amended) A medication delivery device comprising:

a cartridge assembly[,] having a distal end and a proximal end [one end sealed with a pierceable sealing], said distal end of the cartridge assembly comprising coupling means for releasably mounting a needle assembly, and said cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a plunger means for acting on said stopper and a dose-setting and injection mechanism for setting a specified dose and for driving said plunger means to deliver the selected dose, and

[and optionally] a needle assembly including a coupling means for engaging the coupling means of said cartridge assembly to form a releasable coupling between said needle assembly and said cartridge assembly,

wherein the cartridge assembly and the dosing assembly are releasably coupled together, and [the device further comprises means for securing] wherein the combination of couplings between the dosing assembly and the cartridge assembly, and between the needle assembly and the cartridge assembly, respectively, is selected to secure that the plunger means abuts on the stopper during [use of the device] coupling and decoupling of the needle assembly.

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/349,748	07/08/99	BUCH-RASMUSSEN T	5533.200-US

QM32/0824

STEVE T ZELSON ESQ
NOVO NORDISK OF NORTH AMERICA INC
SUITE 6400
405 LEXINGTON AVENUE
NEW YORK NY 10174-6400

EXAMINER	
SIRMONS, K	
ART UNIT	PAPER NUMBER
3763	

DATE MAILED: 08/24/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 11/00)

1- File Copy

Office Action Summary	Application No. 09/349,748	Applicant(s) BUCH-RASMUSSEN ET AL.
	Examiner Kevin C. Simons	Art Unit 3763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is FINAL. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13 and 19-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13 and 19-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

U.S. Patent and Trademark Office

DETAILED ACTION

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "injection mechanism" must be clearly shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-12 and 28-30 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As to claims 1 and 28, it is unclear what applicant regards as the injection mechanism.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-12 and 19-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Chanoch U.S. Pat. No. 5,688,251.

Chanoch discloses a medication delivery device comprising: a cartridge assembly having a distal end and a proximal end (300), said distal end of the cartridge assembly comprising coupling means (303) for releasably mounting a needle assembly, and said cartridge assembly comprising a cartridge having one end with a pierceable seal (fig. 2 and 3) and having a stopper (125 or 355) adapted to receive a plunger means (figs. 1-4), a dosing assembly (figs. 1-4) comprising a plunger means for acting on said stopper and a dose-setting and injection mechanism for setting a specified dose and for driving said plunger means to deliver the selected dose (figs. 1-4), and a needle assembly including a coupling means for engaging the coupling means of said cartridge assembly to form a releasable coupling between said needle assembly and said cartridge assembly (figs. 1-4), wherein the cartridge assembly and the dosing assembly are reliably coupled together, and wherein the combination of couplings between the dosing assembly and the cartridge assembly, and between the needle assembly and the cartridge assembly, respectively, is selected to secure that the plunger means abuts on the stopper during coupling and decoupling of the needle assembly (figs. 1-4); as to claims 2-12 and 19-27 , (figs. 1-4).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 28-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chanoch U.S. Pat. No. 5,688,251.

Chanoch discloses a medication delivery device substantially as claimed, however, it is not clear if Chanoch discloses a first and second releasable couplings that are of different types. Nevertheless, Chanoch clearly discloses other means for mounting the needle assembly to the cartridge assembly may be used (col. 8, lines 15-20). Therefore, it would have been obvious to one of ordinary skill at the time the invention was made to modify the releasable couplings of Chanoch to have various and different types of connections for quicker disconnection.

Response to Arguments

Applicant's arguments with respect to claim1-13 and 19-33 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed,

and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Kevin C. Sirmons whose telephone number is (703)306-5410. The examiner can normally be reached on Monday - Thursday from 6:30 am to 4:00 pm. The examiner can also be reached on alternate Fridays.

KCS

Kevin C. Sirmons
Patent Examiner
8/22/01

RICHARD K. SEIDEL
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3700

Form PTO 948 (Rev. 8-98) U.S. DEPARTMENT OF COMMERCE - Patent and Trademark Office Application No. 349,748

NOTICE OF DRAFTSPERSON'S PATENT DRAWING REVIEW

The drawing(s) filed (insert date) 7/8/99 are:

A. ☐ approved by the Draftsperson under 37 CFR 1.84 or 1.152.

B. ☒ objected to by the Draftsperson under 37 CFR 1.84 or 1.152 for the reasons indicated below. The Examiner will require submission of new, corrected drawings when necessary. Corrected drawing must be submitted according to the instructions on the back of this notice.

1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings: Black ink. Color.
   - ___ Color drawings are not acceptable until petition is granted. Fig(s) ___
   - ___ Pencil and non black ink not permitted. Fig(s) ___
2. PHOTOGRAPHS. 37 CFR 1.84 (b)
   - ___ Full-tone set is required. Fig(s) ___
   - ___ Photographs not properly mounted (must use bristol board or photographic double-weight paper). Fig(s) ___
   - ___ Poor quality (half-tone). Fig(s) ___
3. TYPE OF PAPER. 37 CFR 1.84(e)
   - ___ Paper not flexible, strong, white, and durable. Fig(s) ___
   - ___ Erasures, alterations, overwritings, interlineations, folds, copy machine marks not accepted. Fig(s) ___
   - ___ Mylar, vellum paper is not acceptable (too thin). Fig(s) ___
4. SIZE OF PAPER. 37 CFR 1.84(f): Acceptable sizes:
   - ___ 21.0 cm by 29.7 cm (DIN size A4)
   - ___ 21.6 cm by 27.9 cm (8 1/2 x 11 inches)
   - ___ All drawing sheets not the same size. Sheet(s) ___
   - ___ Drawings sheets not an acceptable size. Fig(s) ___
5. MARGINS. 37 CFR 1.84(g): Acceptable margins:

   Top 2.5 cm Left 2.5cm Right 1.5 cm Bottom 1.0 cm SIZE: A4 Size

   Top 2.5 cm Left 2.5 cm Right 1.5 cm Bottom 1.0 cm SIZE: 8 1/2 x 11

   Margins not acceptable. Fig(s) ___
   - ___ Top (T) ___ Left (L)
   - ___ Right (R) ___ Bottom (B)
6. VIEWS. 37 CFR 1.84(h)

   REMINDER: Specification may require revision to correspond to drawing changes.

   Partial views. 37 CFR 1.84(h)(2)
   - ___ Brackets needed to show figure as one entity. Fig(s) ___
   - ___ Views not labeled separately or properly. Fig(s) ___
   - ___ Enlarged view not labeled separately or properly. Fig(s) ___
7. SECTIONAL VIEWS. 37 CFR 1.84 (h)(3)
   - ___ Hatching not indicated for sectional portions of an object. Fig(s) ___
   - ___ Sectional designation should be noted with Arabic or Roman numbers. Fig(s) ___
8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)
   - ___ Words do not appear on a horizontal, left-to-right fashion when page is either upright or turned so that the top becomes the right side, except for graphs. Fig(s) ___
9. SCALE. 37 CFR 1.84(k)
   - ___ Scale not large enough to show mechanism without crowding when drawing is reduced in size to two-thirds in reproduction. Fig(s) ___
10. CHARACTER OF LINES, NUMBERS, & LETTERS. 37 CFR 1.84(l)
    - ☒ Lines, numbers & letters not uniformly thick and well defined, clean, durable, and black (poor line quality). Fig(s) 2 thru 8
11. SHADING. 37 CFR 1.84(m)
    - ___ Solid black areas pale. Fig(s) ___
    - ___ Solid black shading not permitted. Fig(s) ___
    - ___ Shade lines, pale, rough and blurred. Fig(s) ___
12. NUMBERS, LETTERS, & REFERENCE CHARACTERS. 37 CFR 1.84(p)
    - ___ Numbers and reference characters not plain and legible. Fig(s) ___
    - ___ Figure legends are poor. Fig(s) ___
    - ___ Numbers and reference characters not oriented in the same direction as the view. 37 CFR 1.84(p)(1) Fig(s) ___
    - ___ English alphabet not used. 37 CFR 1.84(p)(2) Fig(s) ___
    - ___ Numbers, letters and reference characters must be at least .32 cm (1/8 inch) in height. 37 CFR 1.84(p)(3) Fig(s) ___
13. LEAD LINES. 37 CFR 1.84(q)
    - ___ Lead lines cross each other. Fig(s) ___
    - ___ Lead lines missing. Fig(s) ___
14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.84(t)
    - ___ Sheets not numbered consecutively, and in Arabic numerals beginning with number 1. Sheet(s) ___
15. NUMBERING OF VIEWS. 37 CFR 1.84(u)
    - ___ Views not numbered consecutively, and in Arabic numerals, beginning with number 1. Fig(s) ___
16. CORRECTIONS. 37 CFR 1.84(v)
    - ___ Corrections not made from prior PTO-948 dated ___
17. DESIGN DRAWINGS. 37 CFR 1.152
    - ___ Surface shading shown not appropriate. Fig(s) ___
    - ___ Solid black shading not used for color contrast. Fig(s) ___

COMMENTS

REVIEWER S. Fields DATE 12/23/99 TELEPHONE NO. 703 305-8335

ATTACHMENT TO PAPER NO. ___

INFORMATION ON HOW TO EFFECT DRAWING CHANGES

1. Correction of Informalities--37 CFR 1.85

File new drawings with the changes incorporated therein. The application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application, should be placed on the back of each sheet of drawings in accordance with 37 CFR 1.84(c). Applicant may delay filing of the new drawings until receipt of the Notice of Allowability (PTOL-37). Extensions of time may be obtained under the provisions of 37 CFR 1.136. The drawing should be filed as a separate paper with a transmittal letter addressed to the Drawing Processing Branch.

2. Timing for Corrections

Applicant is required to submit acceptable corrected drawings within the three-month shortened statutory period set in the Notice of Allowability (PTOL-37). If a correction is determined to be unacceptable by the Office, applicant must arrange to have acceptable corrections resubmitted within the original three-month period to avoid the necessity of obtaining an extension of time and paying the extension fee. Therefore, applicant should file corrected drawings as soon a possible.

Failure to take corrective action within set (or extended) period will result in ABANDONMENT of the Application.

3. Corrections other than Informalities Noted by the Drawing Review Branch on the Form PTO-948

All changes to the drawings, other than informalities noted by the Drawing Review Branch, MUST be approved by the examiner before the application will be allowed. No changes will be permitted to be made, other than correction of informalities, unless the examiner has approved the proposed changes.

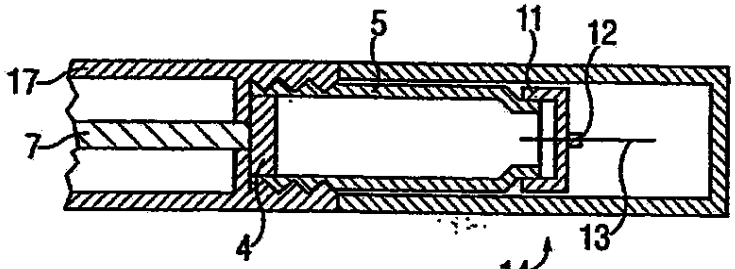

FIG. 2a

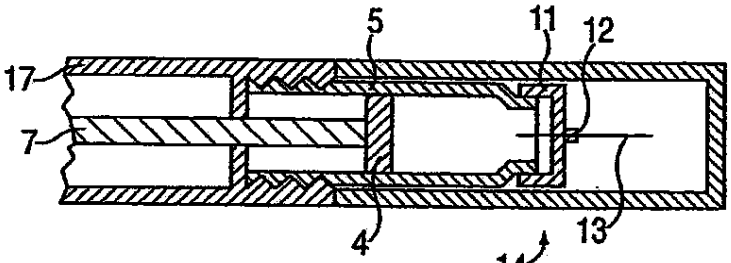

FIG. 2b

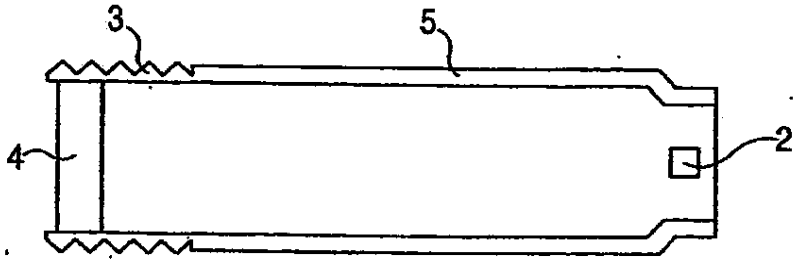

FIG. 3

09/349,748
Buch-Rasmussen et

RECEIVED
JAN 16 2002
TECHNOLOGY CENTER R3700

AF/3763

Docket No. 5533.200-US

SKADDEN, ARPS, SLATE, MEAGHER & FLOM LLP
FOUR TIMES SQUARE
NEW YORK 10036-6522
(212) 735-3000
FAX: (212) 735-2000

Applicant(s) : Buch-Rasmussen et al.

Serial No. : 09/349,748 Examiner: Sirmons, K.

Filed : July 8, 1999 Art Unit: 3763

Title : Medical Device

AMENDMENT TRANSMITTAL
AND REQUEST FOR EXTENSION OF TIME

Date: December 10, 2001

Box AF
Assistant Commissioner For Patents
Washington, DC 20231

Sir:

I hereby certify that this paper is being deposited with the United States Postal Service, as first class mail, in an envelope addressed to: Assistant Commissioner for Patents, Washington, DC 20231, on December 10, 2001.

Robert B. Smith Reg. No. 28,538

Robert B. Smith
Signature

December 10, 2001
Date

Transmitted herewith is an Amendment in the above-identified application.

1. ( ) No additional fee is required.

01/14/2002 CCHAUI 00000092 192385 09349748
01 FC:115 110.00 CH

2. ( ) The fee has been calculated as shown below:

Claims remaining	Prior Paid Claims	Extra	Rate	Fee
Total:	minus (at least 20) =	@	$18	= $
Independent	minus (at least 3) =	@	$80	= $___

TOTAL ADDITIONAL FEE: $

3. (X) An extension of time to respond to the PTO Communication dated August 24, 2001 is hereby requested. The required fee is indicated below:

Within first month:	(X)	$ 110
Within second month	( )	$ 400
Within third month	( )	$ 920
Within fourth month	( )	$1,440
Within the fifth month	( )	$1,960

4. ( ) Enclosed please find a check in the amount of $ 0.00 representing (a) additional claims fee ($ 0) and (b) the extension fee ($ 0).

5. (X) The Commissioner is hereby authorized to charge the amount of $ 110.00 representing (a) additional claims fee ($); and (b) the extension fee ($ 110) to deposit account No. 19-2385. A copy of this sheet is enclosed for such purpose.

6. (X) In the event that an extension of time is required and applicant has inadvertently overlooked the need to request a petition and file the fee, the applicant hereby petitions for such extension of time. The Commissioner is authorized to charge the required fee to deposit account No. 19-2385. A copy of this sheet is enclosed for such purpose.

7. (X) The Commissioner is hereby authorized to charge payment of any additional fees required in connection with this application, and credit any overpayment, to deposit account No. 19-2385. A copy of this sheet is enclosed.

Skadden, Arps, Slate, Meagher & Flom

By Robert B. Smith

Robert B. Smith
Registration No. 28,538
Attorneys for Applicant(s)
(212) 735-3020

Docket No. 5533.200-US #14

Amdt C
D. Boyce
1/17/02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s)	:	Buch-Rasmussen et al.	
Serial No.	:	09/349,748	Examiner: Simmons, K.
Filed	:	July 8, 1999	Art Unit: 3763
Title	:	Medical Device	

I hereby certify that this paper is being deposited with the United States Postal Service, as first class mail, in an envelope addressed to: Assistant Commissioner for Patents, Washington, DC 20231, on December 10, 2001.

Robert B. Smith — Reg. No. 28,538

Robert B. Smith — December 10, 2001
Signature — Date

December 10, 2001

AMENDMENT AFTER FINAL REJECTION

Box AF
Assistant Commissioner For Patents
Washington, DC 20231

Sir:

In response to the Office Action dated August 24, 2000, the applicants respectfully request entry of the following amendments, to render the claims allowable or at least in better form for appeal:

IN THE CLAIMS:

Cancel claims 2-18, 20, and 24.

Replace claims 1, 21, 25, 28, and 31 with the following claims:

1. (Twice Amended) A medication delivery device comprising:

a cartridge assembly having a distal end and a proximal end, said distal end of the cartridge assembly comprising coupling means for releasably mounting a needle assembly, and said cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a plunger means for acting on said stopper, a mechanism for setting a specified dose, and a driving means for advancing said plunger means to deliver the set dose, and

a needle assembly including a coupling means for engaging the coupling means of said cartridge assembly to form a releasable coupling between said needle assembly and said cartridge assembly,

wherein the cartridge assembly and the dosing assembly are releasably coupled together, and wherein the combination of couplings between the dosing assembly and the cartridge assembly, and between the needle assembly and the cartridge assembly, respectively, is selected to ensure that the force applied to couple and decouple said needle assembly to and from said cartridge assembly does not cause said dosing assembly to move away from said cartridge assembly during coupling and decoupling of said needle assembly, such that said plunger means remains in abutment with said stopper during such coupling and decoupling.

21. (Amended) A medication delivery device according to claim 1, wherein the dosing assembly is released from the cartridge assembly through a movement including an axial movement.

25. (Amended) A medication delivery device according to claim 1, wherein the cartridge assembly comprises a housing for receiving a cartridge.

28. (Amended) A medication delivery device comprising:

a cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a plunger means for acting on said stopper, a mechanism for setting a specified dose, and a drive means for advancing said plunger means to deliver the set dose, and

a needle assembly,

a first releasable coupling between the needle assembly and the cartridge assembly, and

a second releasable coupling between the cartridge assembly and the dosing assembly, wherein said first and second releasable couplings are of different types and are selected such that the force applied to couple and decouple said needle assembly to and from said cartridge assembly does not urge said second releasable coupling to disengage, thereby ensuring that said dosing assembly does not move away from said cartridge assembly during coupling and decoupling of said needle assembly, such that said plunger means remains in abutment with said stopper.

31. (Amended) A medication delivery device comprising:

a cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a housing and a plunger means movable relative to said housing for acting on said stopper,

a needle assembly,

a first releasable coupling between the needle assembly and the cartridge assembly, and a second releasable coupling between the cartridge assembly and the dosing assembly housing, wherein said first and second releasable couplings are of different types and are selected such that the force applied to couple and decouple said needle assembly to and from said cartridge assembly does not urge said second releasable coupling to disengage, thereby ensuring that the dosing assembly does not move away from the cartridge assembly during coupling and decoupling of said needle assembly, such that said plunger means remains in abutment with said stopper.

REMARKS

Enclosed herewith is a new sheet of formal drawings containing Figs. 2a, 2b, and 3, which is submitted to overcome the objection raised in the Notice of Draftsperson's Patent Drawing Review.

The applicants respectfully request entry of the foregoing amendments to the claims. By the foregoing amendments, the non-elected claims (13-18) would be canceled, along with dependent claims 2-12, 20, and 24. In addition, independent claims 1 and 28 would be amended to overcome the rejection under 35 U.S.C. § 112 (i.e., that it is unclear what the applicant regards as the injection mechanism). As amended, such claims would recite a mechanism for setting a specified dose, e.g., dose setting wheel 9, and a "driving means" for advancing the plunger means (e.g., plunger rod 7). As disclosed in the specification on page 6, the "driving means" includes the actuator button 18 together with any suitable mechanism for advancing the plunger rod element 7 in response to actuating the actuator button 18. Page 6, lines 18-25.

The Examiner objected to the drawings as not showing an "injection mechanism." As noted above, the term "injection mechanism" has been replaced by the term "driving means" for clarity. The drawings expressly show part of a suitable "driving means," in the form of the actuator button 18. Page 6, lines 24-25. Moreover, the specification discloses that the remaining part of the driving mechanism is contained in the dosing assembly housing 17. Page 6, lines 12-25. Thus, element 17

schematically depicts the remaining parts of the "driving means." Because driving mechanisms which advance the plunger rod in response to depressing an actuator button are well known, and because the specification discloses that any suitable driving mechanism may be employed, Page 6, lines 12-25, the applicants respectfully submit that the drawings need only show such mechanism schematically, as the current drawings do. Thus, the applicants respectfully request reconsideration of the objection to the drawings in light of the change in terminology in claims 1 and 28.

By the foregoing amendments, independent claims 1, 28, and 31 would be amended to clarify the function of selecting the first and second couplings in the manner already specified in those claims, in order to point out more clearly the novel features of the claimed invention.

In the device according to claims 1, 28, and 31, a plunger means, such as a rigid or flexible piston rod, pushes a movable stopper in the cartridge barrel in a forward direction in order to administer set doses of medicine. A dose setting mechanism is used to set the size of the dose. When the dose is administered, the piston rod is pushed forward a distance proportional to the set dose, pushing the stopper forward by exactly the same distance. In order to administer accurate doses, it is essential that, between doses, the forward end of the piston rod is not allowed to retract from the stopper. If that were to occur, the initial portion of the piston rod movement, when administering the next dose, would merely close the gap between

the piston rod and the stopper. Because less than the entire movement of the piston rod would push the stopper, a dose smaller than the set dose would be administered.

In conventional durable insulin syringes ("durable" meaning that the cartridge can be replaced), the cartridge assembly is coupled to the dosing assembly by threads. A needle assembly is also removably mounted on the cartridge assembly by threads. The former coupling allows the cartridge (or the entire cartridge assembly, if the cartridge assembly does not contain a separate cartridge holder, such as is shown in Figs. 1-3 of the present application) to be changed when empty. The latter coupling permits the needle to be removed from the device after a dose has been administered, and replaced when a new dose is to be administered.

Because the two threaded couplings are coaxial with one another, if the user grasps the dosing assembly housing when screwing or unscrewing the needle assembly, the cartridge assembly may rotate relative to the dosing assembly housing. If this occurs, the dosing assembly will move, at least by a small distance, in a direction away from the cartridge assembly, causing the piston rod to move axially away from the stopper. And, if the user does not notice such separation, and does not screw the cartridge assembly back into its original, seated position in the dosing assembly, as noted above the next dose administered will be less than the set dose, because the initial segment of the forward movement of the plunger rod will merely close the gap between the plunger rod and the cartridge stopper, rather than push the stopper forward to expel medicine.

The possibility that mounting or removing the needle assembly will cause the plunger to retract from the stopper is eliminated in the device claimed in claims 1, 28, and 31.

As recited in claim 1, the couplings between the needle assembly and cartridge assembly, on the one hand, and between the cartridge assembly and the dosing assembly, on the other hand, are chosen so as to ensure that the cartridge assembly does not move away from the dosing assembly during coupling and decoupling of the needle assembly. In other words, such couplings are chosen to ensure that the act of mounting ore removing the needle assembly does not cause the dosing assembly to move in a direction away from the stopper. The limitation in claim 1, that the two couplings must be chosen so that they will inherently ensure that such movement between the cartridge assembly and dosing assembly does not occur during needle mounting or removal, ensures that the plunger means will not retract from the stopper during needle mounting and removal.

Claims 28 and 31 recite a preferred structure for ensuring that the plunger will not be retracted from the stopper when changing needles. More particularly, claims 28 and 31 recite that the first and second couplings are different from one another, and further recite that the force applied to couple and decouple the needle assembly will not urge the dosing assembly/cartridge assembly coupling to disengage. In other words, the first and second couplings are chosen such that the force required to disengage the first releasable coupling is in a direction which is

different from the force required to mount or remove the needle assembly. For example, if the first releasable coupling (between the dosing assembly and cartridge assembly) comprises threads, thus requiring a torque about the longitudinal axis to disengage such coupling, the second releasable coupling (for mounting the needle on the cartridge assembly) would not be one which uses a torque about the longitudinal axis to mount and remove the needle.

In the last Office Action, claim 1 was rejected under 35 U.S.C. § 102(b) as being anticipated by Chanoch U.S. patent No. 5,688,251. Claims 28 and 31 were rejected under 35 U.S.C. § 103(a) as being obvious over Chanoch. The Examiner conceded that Chanoch does not disclose the concept of using two different couplings in the same device. However, the Examiner noted that Chanoch discloses that other means for mounting the needle assembly may be used (Col. 8, lines 15-20), and concluded that it would be obvious to modify the releasable couplings of Chanoch to have two different couplings for quicker disconnection. August 24, 2001, Office Action, page 4.

With respect to the anticipation rejection of claim 1, in Chanoch, both couplings are shown as concentric threaded couplings. Therefore, a risk exists that the dosing assembly can be partly unscrewed from the cartridge assembly if the user grasps the dosing assembly housing instead of the cartridge assembly when screwing or unscrewing the needle. Thus, the example disclosed in Chanoch does not have a pair of couplings that will ensure that the dosing assembly will not move away

slightly, i.e., partially separate, from cartridge assembly when the needle is screwed onto or off of the cartridge assembly, as recited in claim 1.

Although Chanoch discloses that alternate couplings can be used to mount the needle assembly on the cartridge assembly, there is no suggestion that, if a different type of coupling type is to be employed to mount the needle, it should be selected to ensure that the force applied in mounting or removing the needle cannot cause the dosing assembly to move away from the cartridge assembly, as recited in claim 1. In other words, Chanoch fails to disclose that the alternative coupling for the needle assembly should be chosen to prevent any possibility that the dosing assembly could rotate relative to the cartridge assembly, and thereby partially unscrew from the cartridge assembly, during needle mounting/removal.

To support a finding of anticipation, a reference must expressly or at least inherently disclose every element of the claim. Continental Can Co. USA v. Monsanto Co., 948 F.2d 1264, 1268, 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). Moreover, in order for a disclosure to be "inherent," the missing descriptive matter must necessarily be present in the prior art reference such that one skilled in the art would recognize such a disclosure. *Id.* In the case of Chanoch, if a different type of coupling were to be chosen for the needle assembly, it would not necessarily ensure that movement between the doser assembly and cartridge assembly, and consequently between the plunger and stopper, is prevented. Because the features recited in claim 1 would necessarily be present if an alternative coupling were to be used for the needle

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assembly, the applicants respectfully submit that Chanoch does not anticipate claim 1.

Because amended claim 1 is not anticipated by Chanoch (and, for reasons discussed below in connection with claims 28 and 31, the features recited in claim 1 are not obvious), the applicants respectfully request allowance of such claim.

With respect to the obviousness rejection of claims 28 and 31, which recite specifically that the coupling pair must be chosen such that the force of mounting or removing the needle will not urge the cartridge assembly/dosing assembly coupling to disengage, the exemplary embodiment in Chanoch does not provide a combination of couplings wherein screwing the needle onto or off of the cartridge assembly will not urge the other coupling to disengage, as recited in claims 28 and 31. In Chanoch, if the user grasps the dosing housing while screwing the needle onto the cartridge assembly housing or unscrewing the needle from such housing, such twisting force will be transmitted across the cartridge assembly/dosing assembly threaded coupling. In one of the two rotational directions, i.e., either screwing the needle on or unscrewing the needle, such twisting force will urge the cartridge assembly to unscrew from the dosing assembly (even if no separation of the two syringe parts actually results).

Although, as the Examiner notes, Chanoch discloses that other couplings can be used for the needle assembly, Chanoch contains no suggestion to select an alternative coupling for the needle assembly such that the force applied in

mounting or removing the needle will be in a direction that will not urge the coupling between the dosing assembly and cartridge assembly to disengage, as recited in claims 28 and 31.

Applicant's disclosure of selecting two couplings that do not interact with one another, i.e., where the actuation of one will never cause actuation of the other, is obvious only in hindsight. While it is true that, if a person skilled in the art were to try different couplings for the needle assembly as suggested in Chanoch, such person might discover that pairing certain couplings produces the benefits of the invention recited in claims 1, 28, and 31, it is well settled that "obvious to try" is an improper standard for determining obviousness. In re Deuel, 51 F.3d 1552, 1559, 34 U.S.P.Q.2d 1210, 1216 (Fed. Cir. 1995).

The conclusion that the invention claimed in claims 1, 28, and 31 is not obvious, except in hindsight, can no better be illustrated than by the fact that, while Chanoch discloses that other needle couplings can be employed, the only embodiment disclosed in Chanoch (i.e., the most preferable embodiment known to Chanoch) utilizes couplings where screwing and unscrewing the needle can cause the dosing assembly/cartridge assembly coupling to partly disengage. Thus, the invention claimed in claims 1, 28, and 31 was not obvious to Chanoch.

The applicants urge the entry of such language changes in claims 28, and 31, insofar as the Examiner already appears to interpret claims 28 and 31 in such a manner. With respect to claim 1, prior to amendment, such claim recited that the

choice of couplings "secure" that the plunger abuts the stopper when the needle is mounted or removed. The term "secure" has been changed to "ensure" for idiomatic reasons, and insofar as the Examiner, in rejecting claim 1 based on anticipation, appears to have given the phrase "secure . . . " no weight. The language revisions thus do not change the scope of the existing claims, and for such reasons entry is respectfully requested.

Finally, the applicants note that claims 1 and 28 would be amended to change the term "selected dose" to "set dose" for clarity, insofar as those claims refer previously to "setting" a dose rather than "selecting" a dose. Such amendment is thus merely of form, to conform the language used in the claim, and does not affect the scope of the claim.

For the reasons discussed above, entry of the proposed amendments, and favorable reconsideration and allowance of the application, are respectfully requested.

Respectfully submitted,

Robert B. Smith

Robert B. Smith
PTO Registration No. 28,538
Attorney for applicant(s)

Skadden, Arps , Slate, Meagher, & Flom
Four Times Square
New York, NY 10036-6522
(212) 735-3020

VERSION WITH MARKINGS TO SHOW CHANGES MADE

CHANGES IN THE AMENDED CLAIMS

1. (Twice Amended) A medication delivery device comprising:

a cartridge assembly having a distal end and a proximal end, said distal end of the cartridge assembly comprising coupling means for releasably mounting a needle assembly, and said cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a plunger means for acting on said stopper, a [and a dose-setting and injection] mechanism for setting a specified dose, and [for driving] a driving means for advancing said plunger means to deliver the [selected] set dose, and

a needle assembly including a coupling means for engaging the coupling means of said cartridge assembly to form a releasable coupling between said needle assembly and said cartridge assembly,

wherein the cartridge assembly and the dosing assembly are releasably coupled together, and wherein the combination of couplings between the dosing assembly and the cartridge assembly, and between the needle assembly and the cartridge assembly, respectively, is selected to [secure] ensure that the force applied to couple and decouple said needle assembly to and from said cartridge assembly

does not cause said dosing assembly to move away from said cartridge assembly during coupling and decoupling of said needle assembly, such that said [the] plunger means [abuts on] remains in abutment with said [the] stopper during such coupling and decoupling [of the needle assembly].

21. (Amended) A medication delivery device according to claim [20] 1, wherein the dosing assembly is released from the cartridge assembly through a movement including an axial movement.

25. (Amended) A medication delivery device according to claim 1, wherein the cartridge assembly comprises a housing for receiving a cartridge.

28. (Amended) A medication delivery device comprising:

a cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a plunger means for acting on said stopper, a [and a dose-setting and injection] mechanism for setting a specified dose, and [for driving] a drive means for advancing said plunger means to deliver the [selected] set dose, and

a needle assembly,

a first releasable coupling between the needle assembly and the cartridge assembly, and

a second releasable coupling between the cartridge assembly and the dosing assembly, wherein said first and second releasable couplings are of different

types and are selected such that the force applied to couple and decouple [releasing or attaching] said needle assembly [onto] to and from said cartridge assembly does not urge said second releasable coupling to disengage, thereby ensuring that said dosing assembly does not move away from said cartridge assembly during coupling and decoupling of said needle assembly, such that said plunger means remains in abutment with said stopper.

31. (Amended) A medication delivery device comprising:

a cartridge assembly comprising a cartridge having one end sealed with a pierceable seal and having a stopper adapted to receive a plunger means,

a dosing assembly comprising a housing and a plunger means movable relative to said housing for acting on said stopper,

a needle assembly,

a first releasable coupling between the needle assembly and the cartridge assembly, and a second releasable coupling between the cartridge assembly and the dosing assembly housing, wherein said first and second releasable couplings are of different types and are selected such that the force applied to couple and decouple [releasing or attaching] said needle assembly [onto] to and from said cartridge assembly does not urge said second releasable coupling to disengage, thereby ensuring that the dosing assembly does not move away from the cartridge assembly during coupling and decoupling of said needle assembly, such that said plunger means remains in abutment with said stopper.

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UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/349,748	07/08/1999	THOMAS BUCH-RASMUSSEN	5533.200-US	7085

26137 7590 02/11/2002

PATENT DEPARTMENT
SKADDEN, ARPS, SLATE, MEAGHER & FLOM LLP
FOUR TIMES SQUARE
NEW YORK, NY 10036

EXAMINER	
SIRMONS, KEVIN C	

ART UNIT	PAPER NUMBER
3763	15

DATE MAILED: 02/11/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Advisory Action	Application No. 09/349,748	Applicant(s) BUCH-RASMUSSEN ET AL
	Examiner Kcs 2/11/02 Kevin C. Simmons	Art Unit 3763

–The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

THE REPLY FILED 16 January 2002 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE. Therefore, further action by the applicant is required to avoid abandonment of this application. A proper reply to a final rejection under 37 CFR 1.113 may only be either: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114.

PERIOD FOR REPLY [check either a) or b)]

a) ☒ The period for reply expires _____ months from the mailing date of the final rejection.

b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection. ONLY CHECK THIS BOX WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

1. ☐ A Notice of Appeal was filed on _____. Appellant's Brief must be filed within the period set forth in 37 CFR 1.192(a), or any extension thereof (37 CFR 1.191(d)), to avoid dismissal of the appeal.

2. ☒ The proposed amendment(s) will not be entered because:

   (a) ☒ they raise new issues that would require further consideration and/or search (see NOTE below);

   (b) ☐ they raise the issue of new matter (see Note below);

   (c) ☐ they are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

   (d) ☐ they present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: *See Continuation Sheet*.

3. ☐ Applicant's reply has overcome the following rejection(s): _____.

4. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

5. ☐ The a)☐ affidavit, b)☐ exhibit, or c)☐ request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.

6. ☐ The affidavit or exhibit will NOT be considered because it is not directed SOLELY to issues which were newly raised by the Examiner in the final rejection.

7. ☒ For purposes of Appeal, the proposed amendment(s) a)☒ will not be entered or b)☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.

   The status of the claim(s) is (or will be) as follows:

   Claim(s) allowed: _____.

   Claim(s) objected to: _____.

   Claim(s) rejected: *1-13 and 19-33*.

   Claim(s) withdrawn from consideration: _____.

8. ☐ The proposed drawing correction filed on _____ is a)☐ approved or b)☐ disapproved by the Examiner.

9. ☐ Note the attached Information Disclosure Statement(s)(PTO-1449) Paper No(s) _____.

10. ☐ Other: _____

Brian L. Casler
Primary Examiner

linuation Sheet (PTO-303)
49,748

Application No.

ntinuation of 2. NOTE: As to claims 1, 28, and 31, applicant has removed some limitations and has narrowed other limitations nging the scope of the claims, thus requiring a new search and consideration .

#16 Docket: 5533.200-US
3-8-02 RCE 3763

Request for Continued Examination (RCE) Transmittal

Application Number	09/349,748
Filing Date	July 8, 1999
First Named Inventor	Thomas Buch-Rasmussen
Group Art Unit	3763
Examiner Name	Simmons, Kevin C.
Attorney Docket Number	5533.200-US

This is a Request for Continued Examination (RCE) under 37 C.F.R. § 1.114 of the above identified application .

1. Submission required under 37 C.F.R. § 1.114:
   - a. ☒ Previously submitted
     - i. ☒ Consider the amendment under 37 CFR 1.116 previously filed on 1/16/02 (mailed 12/10/01).
     - ii. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____.
     - iii. ☐ Other: _____
   - b. ☐ Enclosed
     - i. ☐ Amendment/Response
     - ii. ☐ Affidavit(s)/Declaration(s)
     - iii. ☐ Information Disclosure Statement
     - iv. ☐ Other
2. Request for Extension of Time
   - a. ☒ The applicant(s) respectfully request a 2 month further extension of time (3 months total extension)
3. Fees
   - a. ☒ The Director is hereby authorized to charge the following fees, or credit any overpayments, to Deposit Account No. 19-2385.
     - (i) ☒ RCE fee required under 37 C.F.R. § 1.17(e)
     - (ii) ☒ Extension of time fee (37 C.F.R. §§1.136 and 1.17) ($920 less $110 previously paid = $810)
     - (iii) ☒ Any other fees in connection with this communication..
   - b. ☐ Check in the amount of $ _____ enclosed
   - c. ☐ Payment by credit card (Form PTO-2038 enclosed)

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED			
Name	Robert B. Smith	Registration No.	28,538
Signature	Robert B. Smith	Date:	February 19, 2002

CERTIFICATE OF MAILING OR TRANSMISSION			
I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner For Patents, Box RCE, Washington, DC 20231, or facsimile transmitted to the U.S. Patent and Trademark Office on:			
Name	Robert B. Smith		
Signature	Robert B. Smith	Date	February 19, 2002

03/05/2002 CNGUYEN 00000092 192385 09349748
01 FC:179 740.00 CH
02 FC:117 810.00 CH

Office Action Summary	Application No. 09/349,748	Applicant(s) BUCH-RASMUSSEN ET AL.	
	Examiner Kevin C. Simmons	Art Unit 3763	

– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 February 2002*.

2a)☐ This action is FINAL. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,19,21-23 and 25-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 19, 21-23 and 25-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

U.S. Patent and Trademark Office
PTO-326 (Rev. 04-01) Office Action Summary Part of Paper No. 17

DETAILED ACTION

Request for Continued Examination

The request filed on 2/19/02 for a Request for Continued Examination is acceptable and a RCE has been established. An action on the RCE follows.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 19, 21-23 and 25-27 are rejected under 35 U.S.C. 102(b) as being anticipated by Chanoch U.S. Pat. No. 5,688,251.

Chanoch discloses a medication delivery device comprising: a cartridge assembly having a distal end and a proximal end (300), said distal end of the cartridge assembly comprising coupling means (303) for releasably mounting a needle assembly, and said cartridge assembly comprising a cartridge having one end with a pierceable seal (fig. 2 and 3) and having a stopper (125 or 355) adapted to receive a plunger means (figs. 1-4), a dosing assembly (figs. 1-4) comprising a plunger means for acting on said stopper and a mechanism for setting a specified dose and a driving means for advancing said plunger means to deliver the set dose (figs. 1-4), and a needle assembly including a coupling means for engaging the coupling means of said cartridge assembly to form a releasable coupling between said needle assembly and said cartridge assembly (figs. 1-4),

wherein the cartridge assembly and the dosing assembly are reliably coupled together, and wherein the combination of couplings between the dosing assembly and the cartridge assembly, and between the needle assembly and the cartridge assembly, respectively, is selected to ensure that the force applied to couple and decouple said needle assembly to and from said cartridge assembly does not cause said dosing assembly to move away from the cartridge assembly during coupling and decoupling of said needle assembly, such that said plunger means remains in abutment with said stopper during such coupling (figs. 1-4) and (The device of Chanoch is fully capable of performing the function of applicant's device.); 19, 21-23 and 25-27, (figs. 1-4).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 28-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chanoch U.S. Pat. No. 5,688,251.

Chanoch discloses a medication delivery device substantially as claimed, however, it is not clear if Chanoch discloses a first and second releasable couplings that are of different types. Nevertheless, Chanoch clearly discloses other means for mounting the needle assembly to the cartridge assembly may be used (col. 8, lines 15-20). Therefore, it would have been obvious to one of ordinary skill at the time the invention was made to modify the releasable couplings of Chanoch to have various and different types of connections for quicker disconnection.

Response to Amendment

Drawings

Applicant's has amended the specification (page 5 of remarks). Therefore, the objections to the drawing have been removed.

Response to Arguments

Applicant's arguments with respect to claim 1, 19, 21-23 and 25-33 have been considered but are not persuasive.

In response to applicant's statement that "The Examiner conceded that Chanoch does not disclose the concept of using two different couplings in the same device" applicant clearly has not read the rejection. The rejection without a doubt states that it is not clear if Chanoch discloses first and second releasable couplings that are of different types (see previous and above rejection).

Applicant's arguments are based on hypothetical hindsight. Applicant has not provided the examiner with any facts to support his arguments. It is request that applicant provide documented facts to support his arguments. It is the examiner position that one of ordinary skill in the art would not simply hold the dosing assembly when attempting to unscrew or screw the needle from the cartridge assembly. One would hold the cartridge assembly or the combination of the cartridge assembly and the dosing assembly when attempting to unscrew or screw the needle from the cartridge assembly.

Finally, Chanoch unmistakably discloses that different means for preventing and/or enabling rotation during the dose setting and injection phase may be provided. Similarly, other means for mounting needle cannula to the cartridge holder assembly may be provided (col. 8, lines 14-18). In simple terms, this means that there can be two different types of coupling means on a single device or the coupling means can be the same but something other than threads as shown in the figures.

Conclusion

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Kevin C. Sirmons whose telephone number is (703) 306-5410. The examiner can normally be reached on Monday - Thursday from 6:30 am to 4:00 pm. The examiner can also be reached on alternate Fridays.

Kevin C. Sirmons
Patent Examiner
5/14/02

BRIAN L. CASLER
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3700

3763

Attorney Docket No.: 5533.200-US

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Buch-Rasmussen et al.

Serial No.: 09/349,748

Group Art Unit: 3763

Filed: July 8, 1999

Examiner: K. Simmons

Confirmation No: 7085

For: Medical Device

CERTIFICATE OF MAILING UNDER 37 CFR 1.8(a)

Commissioner for Patents
Washington, DC 20231

Sir:

I hereby certify that the attached correspondence comprising:

1. Amendment No Fee Transmittal
2. Amendment

is being deposited with the United States Postal Service as first class mail in an envelope addressed to:

Commissioner for Patents
Washington, DC 20231

on August 15, 2002.

Tracy Brunner
(name of person mailing paper)

Tracy Brunner
(signature of person mailing paper)

Attorney Docket No.: 5533.200-US

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Buch-Rasmussen et al.

Serial No.: 09/349,748

Group Art Unit: 3763

Filed: July 8, 1999

Examiner: K. Simmons

Confirmation No: 7085

For: Medical Device

AMENDMENT NO FEE TRANSMITTAL

Commissioner for Patents
Washington, DC 20231

Sir:

Transmitted herewith is an Amendment for the above-identified application.

No fee extension fee is required for this Amendment as it is being submitted within the shortened statutory reply period. Please charge any and all additional fees that may due in connection with this paper or application, including the fee for the additional independent claim added by this amendment, estimated to be $84, to Novo Nordisk of North America, Inc., Deposit Account No. 14-1447. A duplicate of this authorization is attached.

Respectfully submitted,

Date: August 15, 2002

Marc A. Began Reg. No. 48,829
Novo Nordisk of North America, Inc.
405 Lexington Avenue, Suite 6400
New York, NY 10174-6401
(212) 867-0123

Attorney Docket No.: 5533.200-US

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Buch-Rasmussen et al.

Application No.: 09/349,748 Group Art Unit: 3763

Filed: February 11, 2002 Examiner: K. Simmons

For: Medical Device

AMENDMENT UNDER 37 C.F.R. 1.111

Commissioner for Patents
Washington, DC 20231

Sir:

In response to the Office Action mailed May 15, 2002, please amend the above-captioned application as follows (a marked up version pursuant to 37 C.F.R. 1.21 is attached hereto, where applicable):

IN THE CLAIMS:

Please cancel claims 1-13 and 19-33 without prejudice or disclaimer.

Please add new claims 34-48 as shown below:

34. A medication delivery device comprising:

a cartridge assembly comprising a cartridge having a pierceable seal at one end and a moveable stopper at an opposite end;

a dosage assembly comprising a plunger means for acting on the stopper; a mechanism for setting a specified dose; and a drive means for advancing the plunger means to deliver the specified dose;

a needle assembly;

a first coupling means for coupling and uncoupling the needle assembly to and from the cartridge assembly;

a second coupling means for coupling and uncoupling the cartridge assembly to and from the dosage assembly;

wherein the first and second coupling means are selected such that when a user grasps the needle assembly and applies a force to couple it to and to uncouple it from the cartridge assembly, while simultaneously grasping the dosage assembly and applying an equal but opposite force thereto, the cartridge assembly cannot not move axially with respect to the dosage assembly.

35. The medication delivery device of claim 34, wherein the first coupling means comprises a means for coupling or uncoupling the needle assembly through an axial movement of the needle assembly relative to the cartridge assembly and the second means comprises a threaded means.

36. The medication delivery device of claim 35, wherein the cartridge assembly comprises a housing for receiving the cartridge and wherein the first coupling means comprises a snap lock and wherein the snap lock is an integral part of the needle assembly.

37. A medication delivery device upon which a needle assembly can be mounted, the device comprising:

a cartridge assembly comprising a cartridge having a movable stopper at one end and a pierceable seal at an opposite end;

a dosage assembly comprising a mechanism for setting a specified dose, a plunger means for abutting the moveable stopper, and a drive means for driving the plunger means to deliver the set doseage;

a first coupling means for coupling and uncoupling the cartridge assembly to and from the dosage assembly; and

a second coupling means for coupling and uncoupling a needle assembly to and from the cartridge assembly;

wherein the first and second coupling means are selected so that when a user grasps the needle assembly and applies force to the needle assembly to couple and uncouple it

from the device while simultaneously grasping the dosage assembly and applying a equal and opposite force to the dosage assembly, the dosage assembly cannot move relative to the cartridge assembly, thereby ensuring that the plunger means remains abutted against the stopper.

38. The medication delivery device recited in claim 37, wherein the second coupling means comprises a threaded coupling means and wherein the second coupling means comprises a means for coupling and uncoupling through an axial movement of the needle assembly relative to the cartridge assembly.

39. The medication delivery device of claim 37, wherein the first coupling means comprises a means for uncoupling through an axial movement of the cartridge assembly relative to the dosing assembly.

40. The medication delivery device of claim 37, wherein the first coupling means comprises a threaded coupling means.

41. The medication delivery device of claim 37, wherein the cartridge assembly comprises a housing to accommodate the cartridge and wherein the second coupling means comprises a means for axially coupling or uncoupling the needle assembly from the cartridge assembly.

42. The medication delivery device of claim 37, wherein the second coupling means comprises a threaded coupling means.

43. A medication delivery device comprising:

a cartridge assembly comprising:

a housing capable of housing a removable cartridge that has a pierceable seal at one end, is filled with medication, and has a moveable stopper at an opposite end that when moved toward the medication pressurizes the medication; and

a needle mounting means for mounting a needle on the cartridge assembly;

a dosage assembly for delivering a set dose of medication, comprising:

a plunger means for moving the stopper, a dose setting means for setting a dose, and a drive means for driving the plunger means to deliver the set dose, wherein after a portion of medication is expelled from the cartridge, the plunger means abuts the stopper;

a first means for coupling and uncoupling a needle assembly to and from the cartridge assembly; and

a second means for coupling and uncoupling the dosage assembly to and from the cartridge assembly,

wherein the first and second coupling means are chosen so that when a user simultaneously grasps the dosage assembly and the needle assembly and applies a force to the needle assembly to couple (or uncouple) the needle to or from the device the cartridge assembly is positively precluded from moving axially relative to the cartridge assembly.

44. A medication delivery device comprising:

a cartridge assembly for housing a removable cartridge containing a medication;

a needle assembly;

a dosage assembly comprising a mechanism for setting a dosage less than the full amount of medication contained in the cartridge;

a first coupling means for coupling and uncoupling the needle to and from a removable cartridge housed in the cartridge assembly; and

a second coupling means for coupling and uncoupling the cartridge assembly to and from the dosage assembly;

wherein the first and second coupling means are chosen so that when a user couples or uncouples the needle assembly from the cartridge by grasping the needle assembly and the dosage assembly simultaneously and applying force to both, the second coupling